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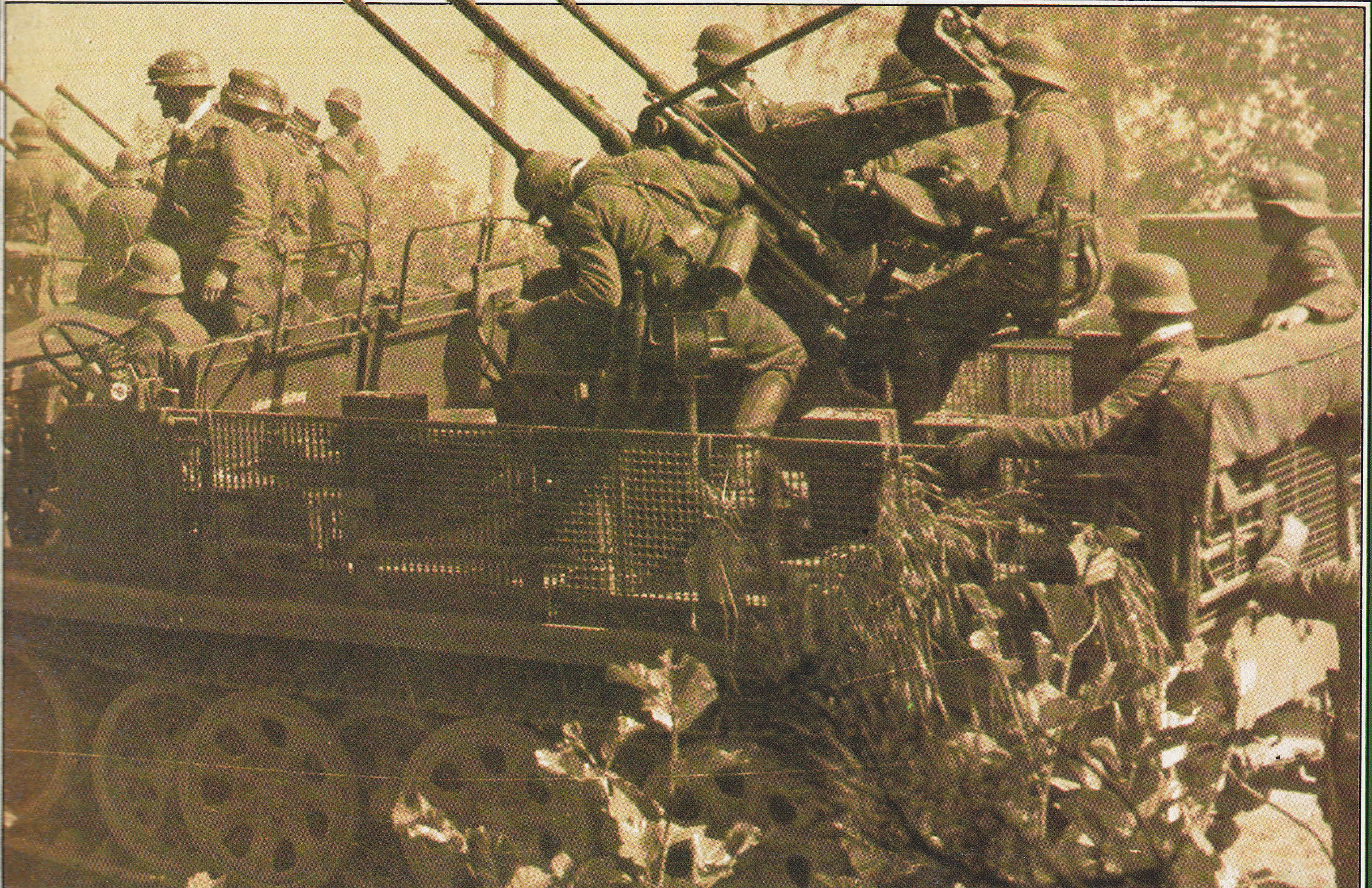

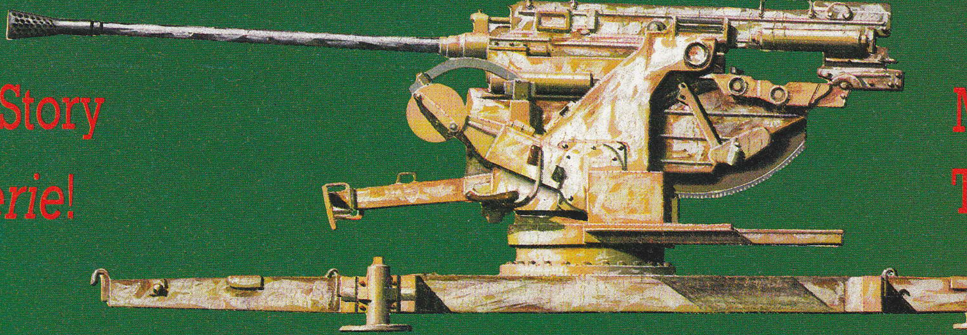

The Bofors Story

Flak Artillerie!

Maastricht – The Wall of Death

A fully illustrated guide to Light AA Guns of World War II

WAR MACHINE

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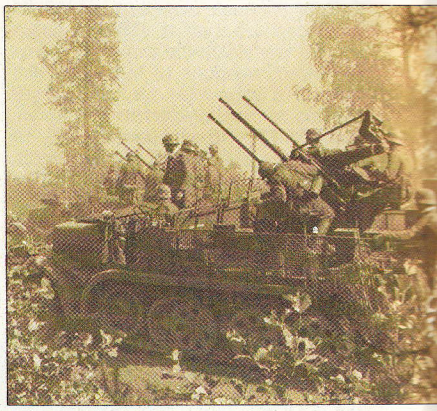
Light AA Guns of World War 11



Part of a battery of 2-cm Flakvierling 38s mounted on SdKfz 7/1 8-ton half-tracks. This gun/half-track combination was developed to provide aerial protection for armoured formations in the field.

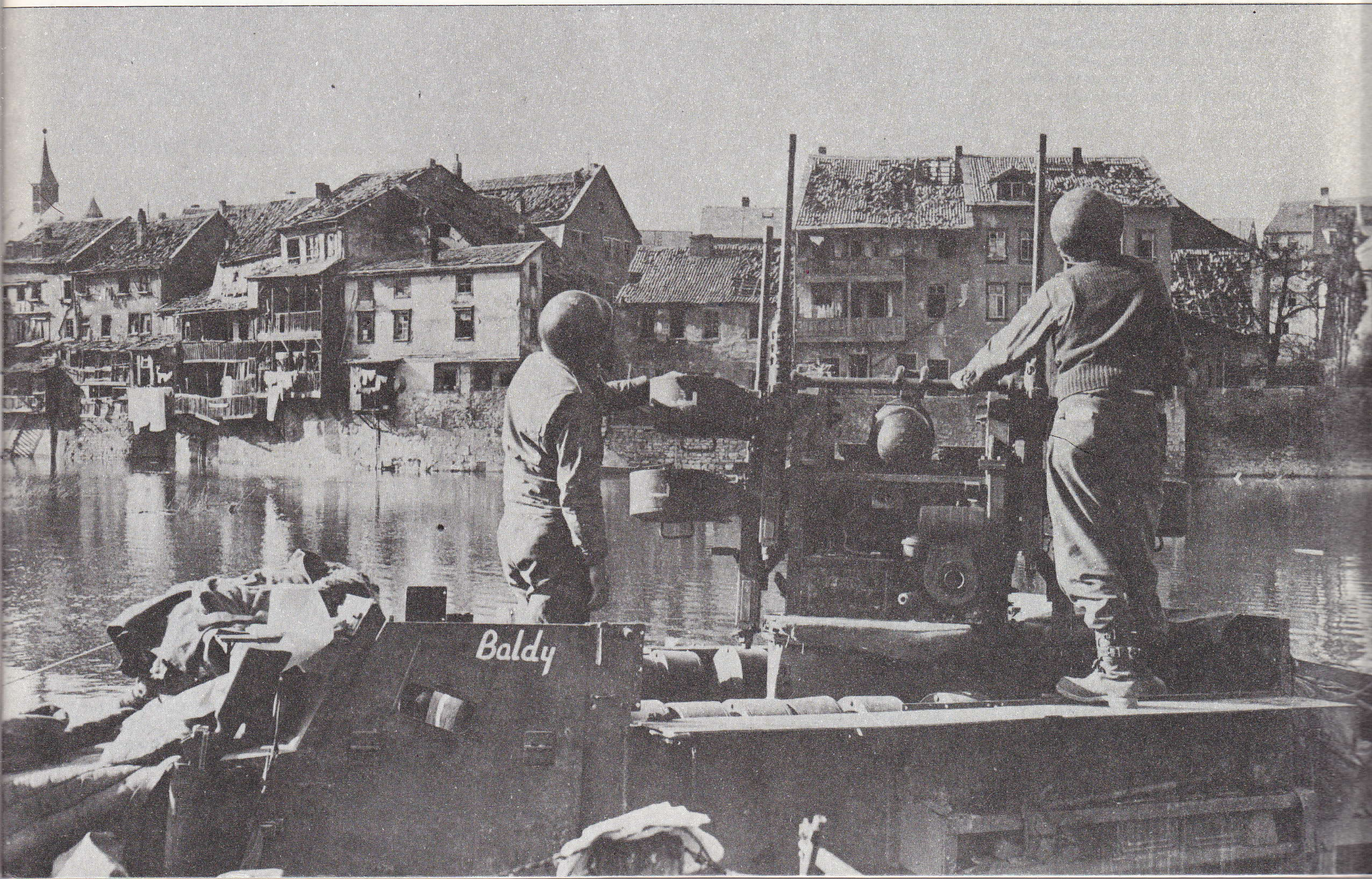
1939 saw tactical air power take its place as a significant factor on the battlefield, its importance calling for newer, more effective methods to protect forces on the ground. High volumes of light anti-aircraft fire were seen to be the answer, with the Wehrmacht taking the lead.

In 1939 the light anti-aircraft gun was relatively new in concept. For the most part such weapons had calibres of between 20 mm (0.787 in) and 40 mm (1.575 in), and were all capable of putting into the air large volumes of automatic fire. They were mainly intended for the defence of an area of sky that extended to no more than 3000 m (9,843 ft) at best, although they were usually employed against targets flying at altitudes much lower than that.

Most of the guns included in this study had a calibre of 20 mm. This calibre had been established by the end of World War I as the optimum for a projectile that could carry a useful explosive payload and yet remain economic to fire automatically, but after 1941 this calibre had to be revised upwards in size as aircraft targets increased in speed and the degree of protection they carried. Some nations, such as Germany, had foreseen this trend and had accordingly equipped with 37-mm (1.457-in) weapons, and it is indicative that the best all-round weapon in this category that was in service during the war years was the Swedish Bofors gun with a calibre of 40 mm, one that is still in widespread use today. But the smaller-calibre weapons remained in use even though the only way that they could ensure a target 'kill' was to increase the number of projectiles actually hitting the target. Since to increase the rate of fire of most guns would in most cases have entailed a major redesign, the only way to boost the weight of fire was to increase the number of barrels firing from one mounting at any one time. The best example of this concept could be seen with the change of the single-barrelled 2-cm Flak 38 to the four-barrelled 2-cm Flakvierling 38, one of the German weapons most feared by Allied tactical flyers.

Not all the guns included in this study attained the fame of the German light Flak weapons. Some, such as the Schneider 37-mm gun, were somewhat less than successful, but others, such as the Bofors gun, the Oerlikon cannon and the Soviet Model 1939, are assured of a place in artillery, if not world, history. They defended the ground forces against tactical attack aircraft and they defended home areas against more formal bomber forces in a war in which the aircraft became a dominant weapon.

The crew of a Multiple Gun Motor Carriage M16 are on the alert in Northern Italy late in the war. The M16 was a Maxson mount carried on an M3 half track and was one of the more widely used of the mobile Maxson mounts. The first of them were produced during early 1943 and they were widely used.



USA

Maxson Mount

One of the main American weapons produced as a counter to the low-flying aircraft was not of the same calibre as the other weapons in this study, for instead of using what are normally regarded as cannon calibres, the American solution used heavy machine-guns with a calibre of 12.7 mm (0.5 in). This was the **Maxson Mount**, which used a combination of four 12.7-mm Browning M2 heavy machine-guns on a single mounting with two guns on each side of a central pedestal-type housing. The proper service designation for this arrangement was **Multiple Caliber .50 Machine-Gun Carriage M51**.

The Maxson Mount was used on a variety of different carriages. One of the most common was a trailer towed by a light truck or even a Jeep. This trailer used twin axles, and in action legs could be lowered to the ground at each corner to provide increased stability when firing. The trailer also carried a number of batteries and a battery-charging set, for the Maxson Mount was electrically powered. The electrical supply was used for elevation and traverse, and the motors used were powerful enough to meet the most demanding calls made upon them by the gunner, who sat on the turret between the two pairs of machine-guns. The motors could move the guns from the horizontal to +60° in one second, and the turret could traverse at the same rate. In order to keep the two main batteries topped up at all times, they were normally kept on constant charge in action.

The combined fire of the four Browning machine-guns was sufficient to bring down any aircraft caught in their fire, despite the fact that the rounds carried no explosive payload. The guns were aimed using a naval reflector sight, but the tracer fired by the guns could also be used to assist aim and some gunners relied on the tracer alone to make fire control corrections.

The Maxson Mount was also used on halftracks as well as towed trailers. On both types of carriage the guns were supplied with 200 rounds each, fed into the guns from belts carried in enclosed chests mounted outboard of the guns. On some turrets the belts could be fed into the guns under electrical control but the normal gun action was more commonly used.

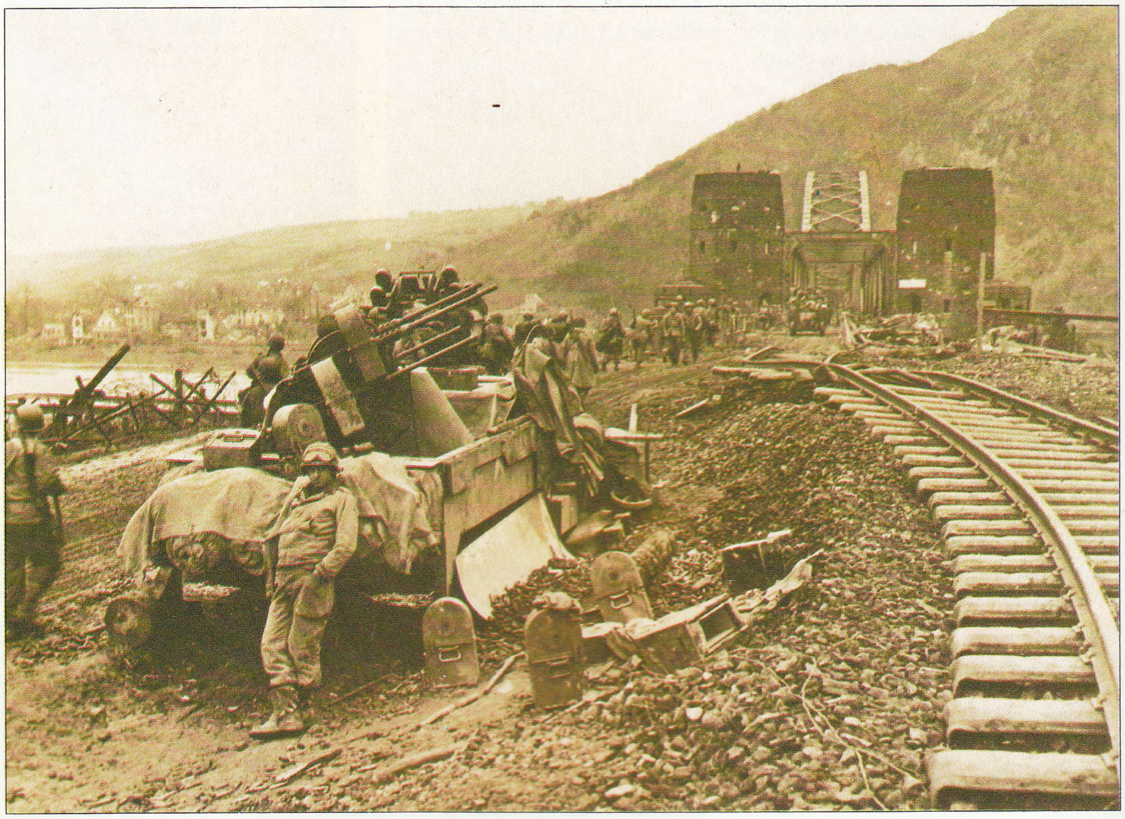
The Maxson Mounts were normally used to provide protection for convoys or mobile units against air attack, and after 1945 continued to serve with many armies. Many are still in use today, but recent years have seen a move away from the retention of the four machine-guns to a new configuration using two 20-mm cannon. Israel has adapted all the Maxson Mounts it has in service to this new form, and Brazil is another nation taking the same path. Israel continues to use its modernized Maxson Mounts on halftracks, but there is a towed version as well.

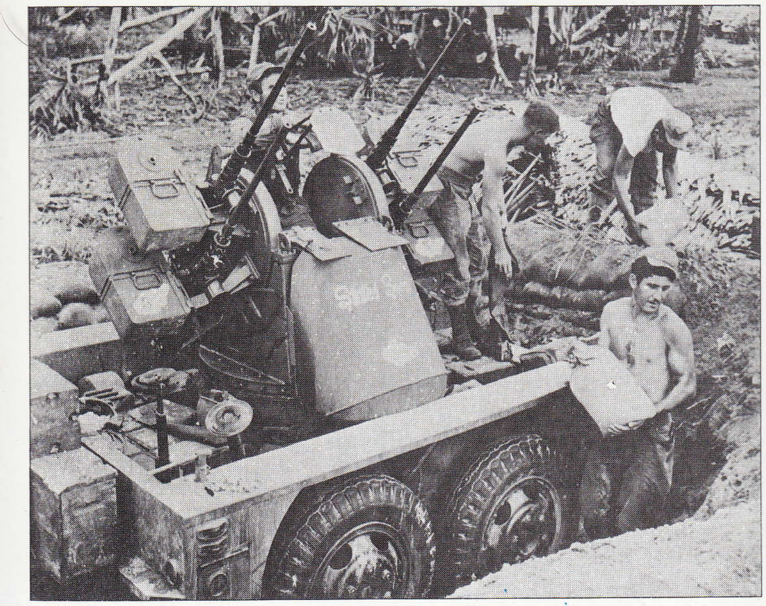
Specification

Maxson Mount

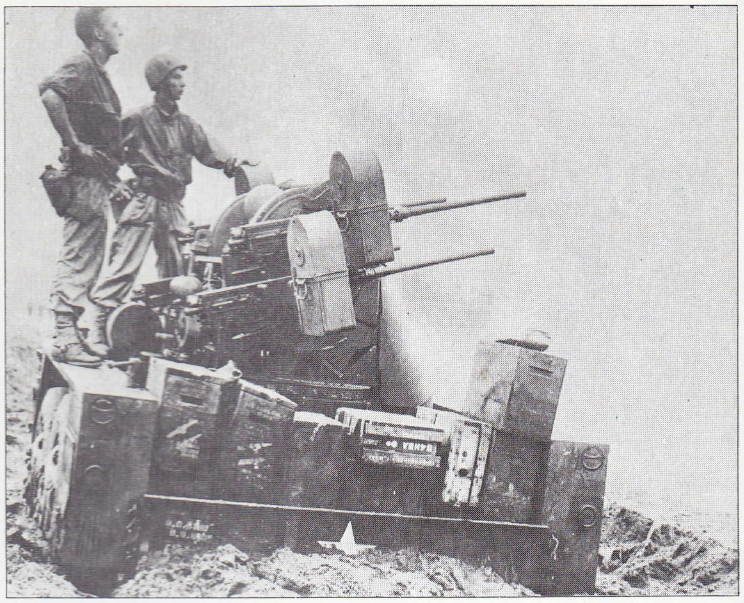
Calibre: 12.7 mm (0.5 in)
Length: (guns) 1.654 m (65.1 in)
Weight: in action 1087 kg (2,396 lb)
Elevation: −5° to +85°
Traverse: 360°
Muzzle velocity: 884 m (2,900 ft) per second
Maximum effective ceiling: about 1000 m (3,280 ft)
Rate of fire: (cyclic, all guns) 2,300 rpm

The crew of a Multiple Gun Motor Carriage M16 relax on stand-by close to the famous bridge at Remagen. The crew have toned down the appearance of the vehicle with hessian and a board over the tracks. Note the spare ammunition magazines.





A Maxson mount is dug in in the Solomons. The gun layout can be clearly seen, as can the box magazines that held up to 200 12.7-mm (0.50-in) rounds. The gunner was seated between the guns and used a reflector sight.

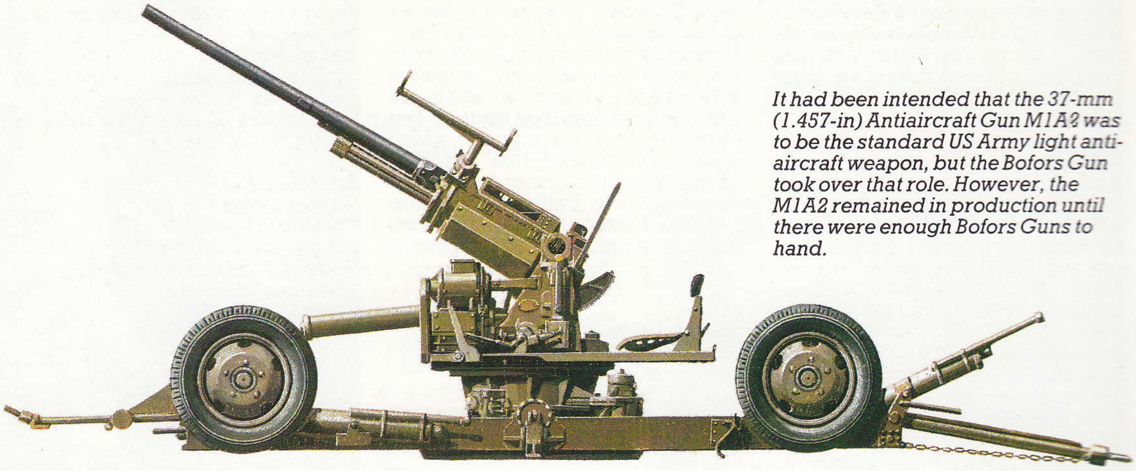


A Multiple Caliber .50 Machine-Gun Carriage M51 is seen in action at Hollandia on New Guinea against low-flying aircraft. This trailer-borne carriage was commonly known as the Maxson mount and the gunner's helmet can just be seen protruding from between the magazines.

USA

37-mm Antiaircraft Gun M1

The development work that led to the **37-mm Antiaircraft Gun M1 on Carriage M3** series started in 1921. It was yet another product of the fertile mind of John M. Browning, who continued to work on the gun until he died in 1926. Development of the project then lapsed until 1934, mainly as a result of defence spending cuts of the period. When work resumed it was not long before the gun was in production, not only for the US Army but for the US Navy (**37-mm AN-M4**) and US Army Air Corps (**37-mm Aircraft Automatic Gun M4** and **M10**) as well. Production started in 1940 under the auspices of the Colt Company, and to some the gun is still known as the **Colt 37 mm**.



It had been intended that the 37-mm (1.457-in) Antiaircraft Gun M1A2 was to be the standard US Army light anti-aircraft weapon, but the Bofors Gun took over that role. However, the M1A2 remained in production until there were enough Bofors Guns to hand.

The 37-mm (1.457-in) gun was an unremarkable design that performed well enough, but it was rather let down by its ammunition which proved to be underpowered and was thus of limited value against low and fast aircraft targets. Various production and carriage changes were introduced until the **M1A2** stage was reached, and at that point the British requested that the Americans should use some of their industrial potential to build Bofors guns for them. A quick perusal of the Bofors gun convinced the Americans that it was much better than their 37-mm design, and they promptly adopted the Bofors in its place. But it was some time before Bofors fabrication could get under way, so the M1A2 continued to roll off the Colt production lines.

Somewhere along the line combat analysis revealed that many anti-aircraft gunners were not using the gunsights to aim their weapons, but were instead watching the tracer elements as they fired and correcting the aim onto the target by this means alone. While this was, and still is, a positive way to aim a gun, at calibres of 37 mm and above, it soon becomes an uneconomic practice on any scale. Accordingly a new **Combination Mount M54** was developed that carried two 12.7-mm (0.5-in) Browning heavy machine-guns, one on each side of the central 37-mm barrel. As the machine-guns were ballistically very similar to the main gun their tracer could be used as the aiming element and once on target the main gun could be fired. This worked out very well in practice. Most of these combination mounts were used on halftracks or on board US Navy vessels right through and after the war, but there was a drawback as far as the original designers were concerned: far from using the two machine-guns as the aiming elements of the combination, many enthusiastic gunners continued to use all three weapons to fire tracer all the time, thereby negating the original intention.

During the war large numbers of M1A2 guns and combination mounts were delivered to the USSR as part of Lend-Lease. Many of these weapons never found their way back to the United States and still appear in odd corners of the world where Soviet influence is paramount. Some remain in service with Warsaw Pact militia forces, long after they have passed from use in the West.

Specification

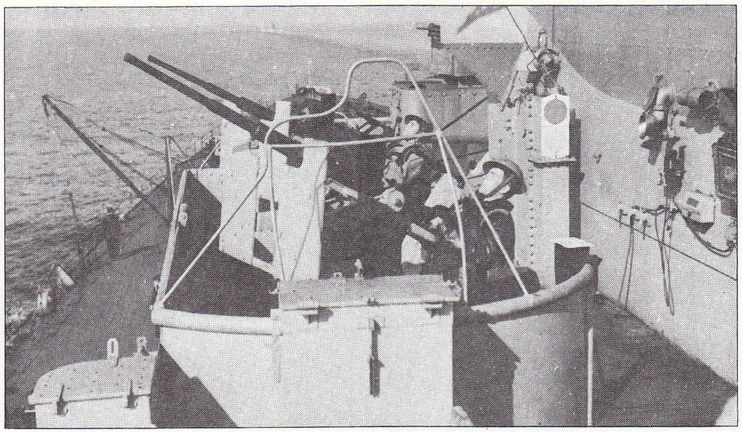
M1A2 on Carriage M3A1
Calibre: 37 mm (1.457 in)
Length of piece: 1.986 m (78.2 in)
Weight: in action 2778 kg (6,124 lb)
Elevation: −5° to +90°
Traverse: 360°
Muzzle velocity: 853 m (2,800 ft) per second
Maximum ceiling: 5669 m (18,600 ft)
Rate of fire: (cyclic) 120 rpm
Projectile weight: 0.61 kg (1.34 lb)

SWITZERLAND

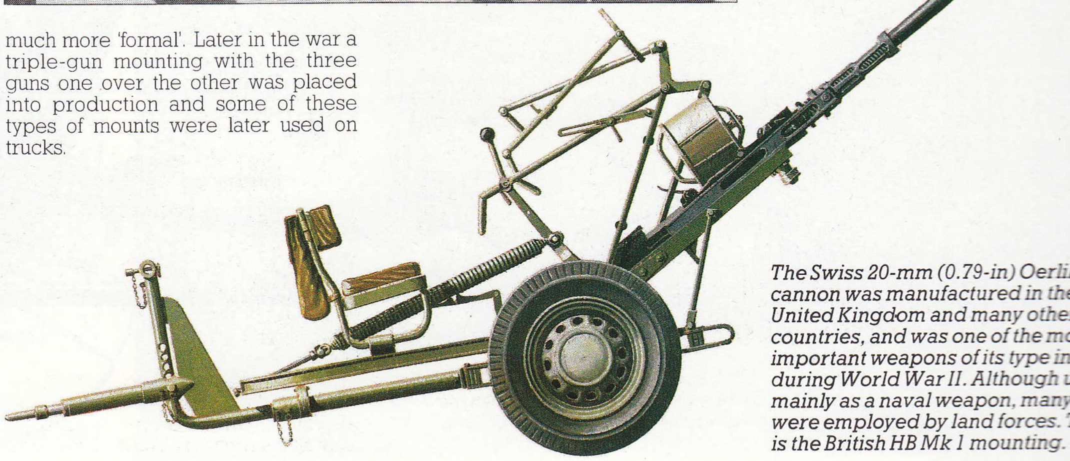
20-mm Oerlikon

The **20-mm Oerlikon** gun has a rather long history, stretching back as far as 1914 when it was produced by one Reinhold Becker in Germany. Versions of this gun were used during World War I as German air force weapons, but in 1919 Becker transferred his brainchild to Switzerland, where it was produced by a firm known as SEMAG until that concern was taken over by the Werkzeug Maschinenfabrik Oerlikon at Oerlikon, still in Switzerland. Under this new concern production of many types of Oerlikon gun expanded greatly (the original Becker weapon as the **Type F**, the SEMAG model as the **Type L** and its own version as the **Type S**), and the usual practice of licence production elsewhere soon followed. France was one early manufacturing location (**2-cm Mitrailleuse C.A. Oerlikon**), and Japan another (**Type 98**). Sales were made worldwide, and Oerlikon aircraft and anti-aircraft guns were a common sight in many nations.

The Oerlikon was a gas-operated gun with the mechanism action assisted by the large coil springs around the barrel that were a recognition feature of the weapon. After 1935 the Oerlikon was produced in the United Kingdom for the Royal Navy so that by 1939 there were considerable numbers of this **Gun, 20-mm, Oerlikon** in use. This was just as well, for by 1940 they were being pressed into service on land mountings of all kinds. Some of these British mountings were simple in the extreme but others such as the Haszard semi-mobile mount were much more 'formal'. Later in the war a triple-gun mounting with the three guns one over the other was placed into production and some of these types of mounts were later used on trucks.



First introduced in its earliest form in 1914, the Oerlikon 20-mm saw its widest service as a naval weapon, as here, mounted on the escort carrier HMS Trumpeter *on convoy duty in 1944.*



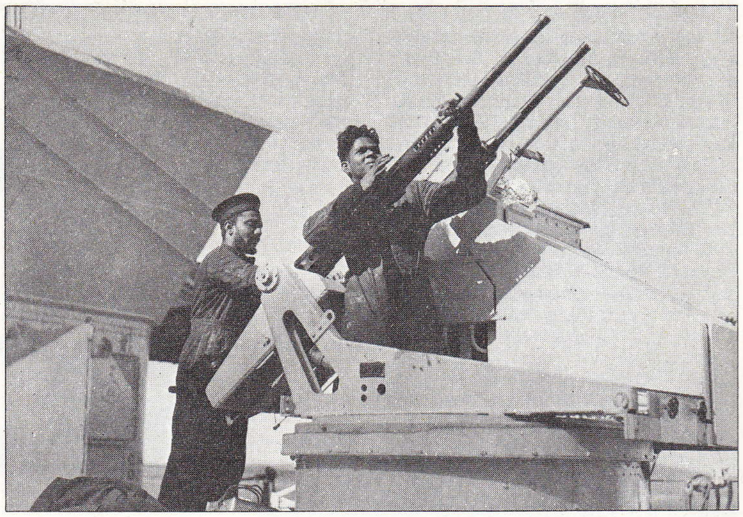
The Swiss 20-mm (0.79-in) Oerlikon cannon was manufactured in the United Kingdom and many other countries, and was one of the most important weapons of its type in use during World War II. Although used mainly as a naval weapon, many were employed by land forces. This is the British HB Mk 1 mounting.

The Oerlikon normally used a 60-round drum magazine for the feed system, but a 20-round box magazine was used on some versions, including those used by the Germans, who knew the Oerlikon as the **2-cm Flak 28** or **Flak 29**, and some of their guns were later passed to the Italians (**Cannone-Mitragliera da 20 Oerlikon**). Over the Atlantic the Americans were producing Oerlikons by 1940 as the **20-mm Automatic Gun Mk IV**, originally for the Royal Navy but later for their own use, and the type was particularly useful in the Pacific against Japanese *kamikaze* attacks. Thus the Oerlikon gun was another of those weapons that started life in a neutral state but ended up being used by all sides, and some of the *kamikaze* aircraft that attacked US Navy shipping were shot down by Oerlikon guns carried on those same ships, firing back at aircraft that also carried Oerlikon guns. The same situation prevailed in Europe, for many Luftwaffe aircraft carried Oerlikon guns of one type or another.

Many of the guns used by the United Kingdom armed forces had their origins in Royal Navy models, but these were fairly easy to adapt to a number of land mountings. At sea most Oerlikons were used on simple pedestal mountings whatever navy happened to be using them. Many are still in use today (but only rarely on land) for they continue to be a popular naval weapon, which cannot be bad for a design that can trace its origins to 1914. Since then it is probable that more Oerlikon Guns have been produced than any other weapon of their type.

Specification

Automatic Gun Mk IV
Calibre: 20 mm (0.787 in)
Length of piece: 2.21 m (87 in)
Weight: (gun only) 66.68 kg (147 lb)
Elevation: − 10° to + 75°
Traverse: 360°
Muzzle velocity: 831 m (2,725 ft) per second
Maximum effective ceiling: 1097 m (3,600 ft)
Rate of fire: (cyclic) 465-480 rpm
Projectile weight: 0.119 kg (0.2625 lb)



Twin 20-mm Oerlikons are cleaned aboard the Indian Navy sloop HMIS Narabda *late in the war. Still in service at sea after more than 70 years, the Oerlikon is now rarely encountered in towed form, although modern guns by the same firm are in wide use on land.*

UK

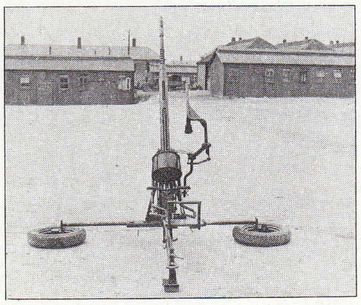
Polsten

In many ways the **Polsten** gun may be regarded as a Polish rather than a British weapon, but it was produced only in the United Kingdom. It had its origins in the fact that although the Oerlikon gun was a highly successful weapon it was difficult to manufacture and required a large number of machining processes. The Poles decided to make production easier: they took the basic design but introduced changes to make the weapon simpler. They were just about to complete the project when the Germans invaded Poland in September 1939. Subsequently the members of the design team fled to the UK, taking their drawings and experience with them and re-established the team there. They were joined by expatriate Czechs and some British designers and in time their results were placed in production in a weapon known as the Polsten ('Pol' after Poland and 'sten' after the British Sten Company, the same company that manufactured the cheap and cheerful Sten sub-machine gun).

The Polsten was a remarkable piece of design and production engineering. The Oerlikon gun used 250 components, but the Polsten reduced this to 119; the costs were considerably reduced as a result, falling from a nominal £320 for the original to between £60 and £70 for the Polsten. Not surprisingly, as soon as the Polsten was ready it was rushed into production. That was in March 1944 and thereafter production of the Oerlikon ceased in favour of the cheaper weapon.

Although the Polsten was cheaper and easier to make it was every bit as effective as the Oerlikon original. The Polsten could fit into any mounting intended for the Oerlikon, so it was used in a diversity of roles ranging from aircraft gun to tank co-axial weapon. On ground mountings it was used as an anti-aircraft gun on a Universal Mounting that could accommodate either an Oerlikon or a Polsten. The same mounting could also accommodate an American Hispano aircraft cannon, also in 20-mm (0.787-in) calibre.

One change that was introduced as standard on the Polsten was a new magazine. The old Oerlikon drum magazine proved to be unpopular in service as it was a bulky and awkward item and took some time to load properly. It was also very difficult to make and consumed a large number of machining operations. On the Polsten it was replaced by a vertical box magazine holding 30 rounds arranged in a 'double-stack' configuration that was not only easier to load but which was much easier to change on the gun. It was also far cheaper to make.

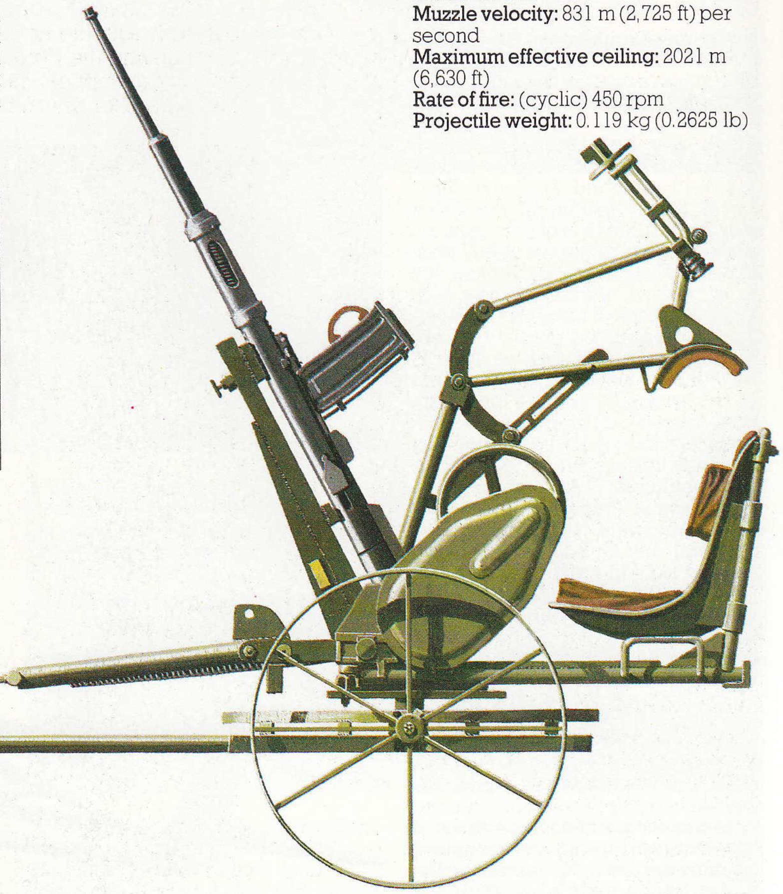


Above: Broken down into its operating position, a Polsten gun shows the sparse construction of this simplified, lightened version of the well-tried Oerlikon.

The Polsten never replaced the Oerlikon gun in service, for although the Oerlikon was expensive it was very robustly made and could last for a very long time. Instead the Polsten and the Oerlikon soldiered on side by side with the British army until both were withdrawn some time during the 1950s. Even now Polstens continue to appear at odd spots around the world, and as the ammunition for them and the Oerlikon is still in widespread production there is no reason why they should not continue to work on for many years to come.

Specification

Polsten (Universal Mounting)
Calibre: 20 mm (0.787 in)
Length of piece: 2.178 m (85.75 in)
Weight: (gun) 54.9 kg (121 lb)
Elevation: − 5° to + 85°
Traverse: 360°
Muzzle velocity: 831 m (2,725 ft) per second
Maximum effective ceiling: 2021 m (6,630 ft)
Rate of fire: (cyclic) 450 rpm
Projectile weight: 0.119 kg (0.2625 lb)



Right: A 20-mm (0.79-in) Polsten Mk 1 Gun on the Mounting, Universal Mk 1 (the wheel outline is diagramatic). The Polsten was a simplified Oerlikon Gun designed by a team of Polish engineers who fled from Poland to the United Kingdom in 1939.

Maastricht - The Wall of Death

The German columns advancing across Europe in 1940 should have presented rich pickings for Allied airmen. Unfortunately for them, the Germans had foreseen the threat from the air and had taken steps to counter it.

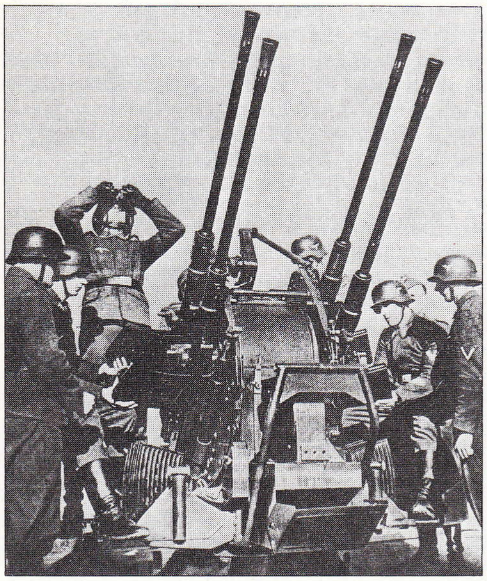
In May 1940 the German army attacked Belgium, France and the Netherlands in a campaign that was to be one of the most successful military operations of all time. In an operation codenamed 'Sichelschnitt' (sickle stroke), the Germans attacked through Belgium to draw forward the bulk of the British and French forces, and then cut through the Ardennes to break through to the Channel coast, so driving a corridor between the Allied northern armies and the rest of France. By so doing the Germans achieved a total victory that all but knocked France out of the war and created a situation where, but for luck, the entire strength of the British army could have been lost.

The French campaign of 1940 was innovative not only for the full use of the now-famous *Blitzkrieg* tactics of the German Panzer formations, but also for the first use of anti-aircraft artillery on a grand scale. It may be argued that anti-aircraft artillery had already come of age during World War I, and that the Spanish Civil War had provided later indications of what was to come, but both of these examples bore little resemblance of what was to happen in France. The equipments of World War I bore no resemblance to the automatic guns that were the primary equipment of the light Flak units of the German army in 1940. In fact May 1940 was to be the first operational use of such weapons on a major scale. The Polish campaign of September 1939 had provided them with few chances to prove their prowess, for much of the ill-fated Polish air force had been driven from the sky by the Luftwaffe in the early days of that lightning campaign.

Both the British and the French air forces were to learn exactly what the German light flak could do during May and June 1940. Both had little prior indication of what to expect. Both air forces were equipped with what now appear to be slow and cumbersome bomber aircraft, though the Royal Air Force considered at the time that it was well-equipped with the single-engine Fairey Battle and the twin-engine Bristol Blenheim. Both carried what seemed then to be a useful bombload, and both were equipped to carry out bombing attacks either at high level or from low altitudes, in the latter case relying on the pilot's ability to release the bombloads at the correct instant. Neither aircraft carried much in the way of defensive armament other than rearward-facing machine-guns.

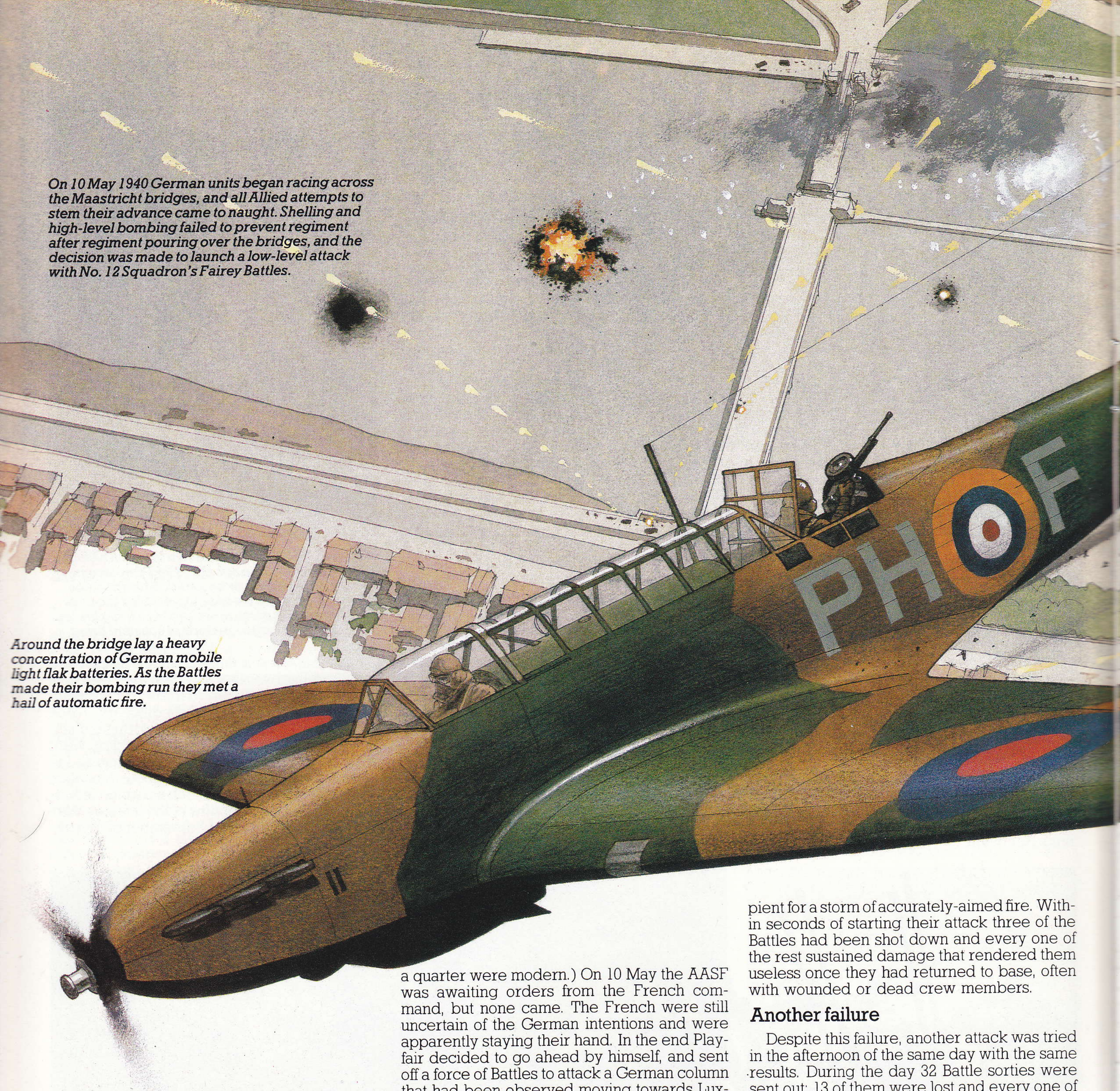
On the ground the German army moved forward its light flak batteries with the leading lines of troops and tanks. As the Germans moved forward they did so under a constant screen of batteries emplaced ready for instant action, but in the early days of the advance through Belgium and the Ardennes there was little enough for them to do. Much of the Royal Air Force strength was in the north and was expected to be used against the German forces advancing through Belgium, but they were initially little employed. Exactly why this happened has to be discovered through the manner in which the French and British forces cooperated. Both the Royal Air Force squadrons in France and the French air force were there primarily to support their armies in the field. Thus orders for the squadrons came via army channels and it was these channels that proved to be less than satisfactory when tried in action. The French army headquarters did not communicate to the British Expeditionary Force (BEF) direct but rather through a tortuous channel of lesser command levels, so orders were frequently delayed or lost simply because the correct man was not at his supposed location when necessary. Added to this was the lethargy imposed by the months of the 'Phoney War' that had prevailed since September of the previous year.

A 2-cm (0.79-in) Flak 30 is shown in action, using what appears to be a special raised emplacement, probably on a range or on a static firing position. Raising the level of the weapon enabled the crew to serve the gun much more easily, making life less tiring over prolonged periods of constant firing.



Above: An emplaced 2-cm Flakvierling 38 in the original Flak 38 platform. All four barrels discharged their spent cartridge cases into a disposal chute at the front.

Right: Gun crews manhandle their 2-cm Flak 30s into position for towing early in the war. Such guns gave Allied pilots a severe shock.



On 10 May 1940 German units began racing across the Maastricht bridges, and all Allied attempts to stem their advance came to naught. Shelling and high-level bombing failed to prevent regiment after regiment pouring over the bridges, and the decision was made to launch a low-level attack with No. 12 Squadron's Fairey Battles.

Around the bridge lay a heavy concentration of German mobile light flak batteries. As the Battles made their bombing run they met a hail of automatic fire.

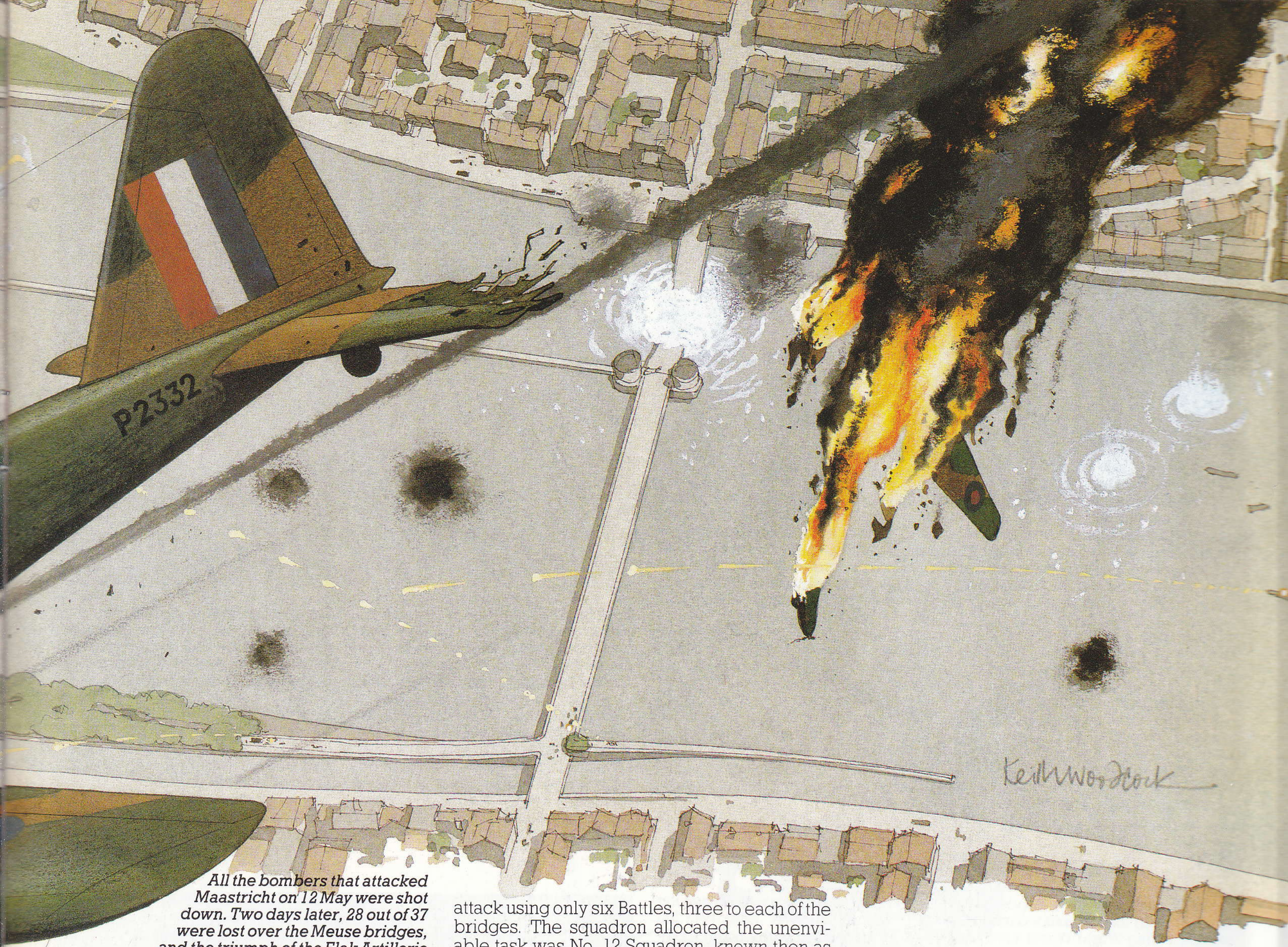
So as the Germans carried out their initial drawing actions by moving through Belgium and attacking the Netherlands, the Allies did little in response other than to advance into Belgium to take up prearranged positions. The Allied air forces took little part in this operation, despite the eagerness of the Royal Air Force Advanced Air Striking Force (AASF) commander, Air Vice-Marshal P.H.L. Playfair. He had at his disposal 10 squadrons of Battles and Blenheims and his remit was to use them where they could be most effective. (One of his secondary functions was to bolster the French air force's bomber strength, for despite the numerical strength of the French in the air they had only about 100 bombers, and of those only a quarter were modern.) On 10 May the AASF was awaiting orders from the French command, but none came. The French were still uncertain of the German intentions and were apparently staying their hand. In the end Playfair decided to go ahead by himself, and sent off a force of Battles to attack a German column that had been observed moving towards Luxembourg.

The result was a harbinger of what was to come. The attacking German column was indeed a powerful one, but was moving under its own light flak screen. Thus as soon as the Battles arrived overhead the German gunners were waiting and ready. They could not believe their good fortune for the Battles had been ordered to attack from a height of about 76 m (250 ft), not from any tactical necessity but because there was no defensive top cover available from the Hawker Hurricane fighter squadrons. By sending the Battles in low, it was hoped that they would escape the worst attentions of the Luftwaffe. As it was they made perfect targets for the light flak. The large span of the Battles combined with their slow speed ensured that every aircraft became the recipient for a storm of accurately-aimed fire. Within seconds of starting their attack three of the Battles had been shot down and every one of the rest sustained damage that rendered them useless once they had returned to base, often with wounded or dead crew members.

Another failure

Despite this failure, another attack was tried in the afternoon of the same day with the same results. During the day 32 Battle sorties were sent out: 13 of them were lost and every one of the rest sustained damage of one sort or another. Not all of these casualties can be assigned to the light flak, for the Luftwaffe was usually waiting nearby to pounce once the flak area had been cleared. The Luftwaffe pilots kept clear of the flak-defended areas, for they had learned the hard way that flak gunners were (as they still are) apt to open fire at any target that presented itself in range and ask questions regarding identity afterwards.

The next day was given over to reconnaissance missions, the Battles and Blenheims again being involved, again to their cost. Eight aircraft were dispatched and only five came back. In contrast, two Blenheim squadrons attacked troop concentrations in the afternoon and came back with only light casualties. But this was not the last raid of the day: in the same



All the bombers that attacked Maastricht on 12 May were shot down. Two days later, 28 out of 37 were lost over the Meuse bridges, and the triumph of the Flak Artillerie was complete.

afternoon eight Battles were sent to attack columns spotted near Luxembourg and none of them returned, for unbeknown to them the Battles flew over areas where the main force of German Panzers was massing for the advance to the Meuse and the subsequent dash to the Channel coast. If the presence of this armour had been reported to the Allied high command, the subsequent course of the campaign might have been different. As it was, the light flak shot the Battles from the sky and those that survived were pounced upon by the Luftwaffe.

Instead, Allied attention was still focused upon Belgium, where a German advance had taken bridges over the Albert Canal at Maastricht. The Germans had crossed the canal on 10 May, and once across had ensured straight away that large numbers of light flak batteries were moved up to defend the bridges. Around each of the two main bridges, one at Maastricht itself and the other at Vroenhoven, the batteries emplaced themselves, marked off the various sectors each was to defend, brought up piles of ammunition, and waited. All this was known to the Allied high command, but on 12 May they decided that an attempt had to be made to cut the bridges. Belgian and French attempts to cut the bridges by shell-fire and high-level bombing had failed, so the British were asked to have a go.

In what now seems to have been a vastly overambitious plan it was decided to make the attack using only six Battles, three to each of the bridges. The squadron allocated the unenviable task was No. 12 Squadron, known then as now as the 'Dirty Dozen' or the 'Flying Foxes' from their squadron crest. It was decided that in view of the risks involved, only volunteers should take part in the mission. In a response that is now part of the best traditions of the Royal Air Force all available crews volunteered at once and the aircraft were made ready with 113.4-kg (250-lb) bombs.

When it came to the take-off only five of the six Battles were serviceable, and despite the sixth crew switching to another aircraft the five took off without them. Three of the Battles flew to the metal bridge at Maastricht (actually at Veldwezelt) and started their attack.

Single hit

The defensive response was overwhelming as it was just what the flak crews were expecting. As soon as each Battle came within range it was met by a curtain of tracer that soon found the range and riddled each airframe with shells. Within seconds all three aircraft were hit and brought down. Only one Battle crew survived to spend the next five years in a prisoner-of-war camp. The other two Battle crews fared no better. In the attack on the concrete bridge at Vroenhoven both were shot down and their crews were killed. The net result of these losses was a single hit by one bomb on the bridge at Maastricht, and the little damage caused was soon repaired.

These losses had been inflicted by the light flak batteries with no help from the Luftwaffe, but they brought no immediate change to the fortune of the Battle squadrons in the remaining days of the French campaign. On 14 May Battles attacked another series of bridges, this time pontoon bridges across the Meuse at Sedan, and at first casualties were light. Then matters changed and it was the death-knell of the Battles. In the course of one hour that afternoon 28 aircraft were lost out of a total of 37 attacking. In its entire history the Royal Air Force has never sustained casualties greater than these, and it meant the virtual end of the AASF. Although more missions were launched, it meant a breaking up of old squadrons to keep others going and gradual withdrawal as the Germans advanced across France to the coast. What was perhaps the worst result for the AASF squadrons was that their casualties had been suffered for so few results, and the Germans hardly checked in their forward momentum at any stage.

But of course there were results in the long term. The power and efficiency of the German light flak weapons was duly acknowledged, and future ground-attack aircraft were to be much faster, better protected and provided with much better offensive weapons. It is a salutary exercise to contrast the success of the Typhoons in 1944 with the failure of the Battles only four years earlier: the Typhoons also had to contend with the German light flak, but they fared immensely better. They at least knew what to expect, whereas the Battle crews of 1940 did not.

JAPAN

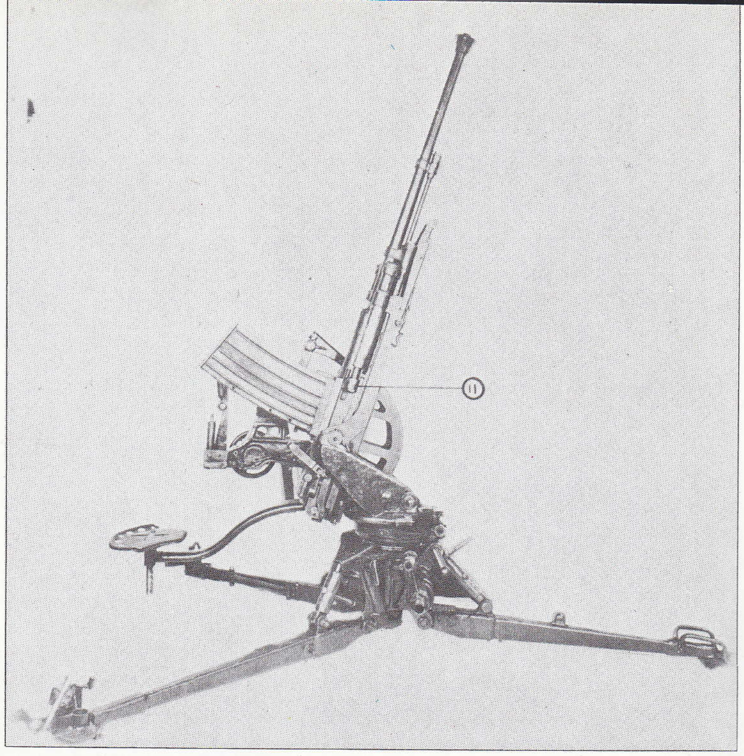
Type 98 20-mm Machine Cannon

The **Army Type 98 20-mm Machine Cannon** was a Japanese army weapon introduced into service in 1938, and was designed from the outset as a dual-purpose weapon capable of use against aircraft and armoured ground targets. Thus it had a rather odd-looking carriage that added to its somewhat archaic appearance. This appearance was deceptive, for the Type 98 was a thoroughly modern weapon with good overall performance.

The carriage was rather high and mounted on two spoked wooden wheels that were used to move the weapon, either as a towed unit behind a light truck or animal team, or by man-handling. Once in position the trail legs opened to form the rear components of a tripod with another outrigger leg forward. Once the tripod had been deployed the wheels were lifted off the ground to permit 360° traverse with the gunner/aimer behind the gun on a small seat. If required the entire weapon could be broken down into separate loads for animal or man-pack transport. It was possible to fire the gun direct from the wheels but since the weapon had a rather high centre of gravity it soon became unstable; moreover, it took only about three minutes to get the gun into action on its tripod with a two- or three-man crew.

The Type 98 was a very hard-hitting weapon. This was due mainly to its 20-mm (0.787-in) ammunition, which was similar to that fired from the Type 97 anti-tank rifle, though the Type 98 ammunition used a slightly longer and wider cartridge case. This cartridge enabled the Type 98 projectiles to penetrate 30 mm (1.18 in) of armour at a range of 247 m (270 yards), so the effect of the same projectile against a low-flying aircraft can well be imagined. According to many accounts the Type 98 was used more in the anti-aircraft than anti-tank role, despite the fact that its cyclic rate of fire was rather low (120 rounds per minute), decreased in service by the use of a box magazine holding 20 rounds in a vertical row.

A twin-barrelled version of the Type 98 was produced in small numbers, but this was not the only other 20-mm weapon used by the Japanese. By 1944 anti-aircraft guns were in great demand and all manner of odd weapons were impressed for the role. Surplus aircraft cannon were one source, and the Japanese navy often gave up precious weapons for extemporized mountings in the defence of strategic islands. Among these were 25-mm (0.98-in) cannon that were lifted direct with their original naval mountings into shore-located weapon pits in single-, double- and triple-barrelled mountings. These **Navy Type 96 25-mm Machine Cannon** weapons had a performance very similar to that of the Army Type 98 and were used by army personnel. To provide these navy weapons with mobility, some were mounted on simple sledges for towing across level ground.



This Type 98 is emplaced for the anti-aircraft role and has the barrel at full elevation. The 20-round box magazine is fitted, and here the figure 11 points to a cocking handle.

The seemingly high carriage is converted to a low and stable firing platform for the anti-aircraft role; note the combination of a muzzle brake with a rather short barrel.

Specification

Type 98
Calibre: 20 mm (0.787 in)
Length of piece: 1.46 m (57.5 in)
Weight: in action 268.77 kg (593 lb)
Elevation: −10° to +85°
Traverse: 360°
Muzzle velocity: 830 m (2,723 ft) per second
Maximum effective ceiling: about 3650 m (11,975 ft)
Rate of fire: 120 rpm
Projectile weight: 0.136 kg (0.3 lb)

ITALY

20-mm Scotti

The Italian army had two standard 20-mm (0.787-in) anti-aircraft weapons in service during World War II. One was the Breda and the other the Scotti, or to give it its full Italian designation, the **Cannone-Mitragliera da 20/77 (Scotti)**, which was also known as the **Mitragliera Isotta Fraschini** from the production facility where it was manufactured; the name Scotti comes from Alfredo Scotti, the designer. The Scotti was first mooted in 1932, and the initial examples were produced in Switzerland at the Oerlikon works, which no doubt accounts for the use of a drum magazine very similar to that of the Oerlikon gun. This drum was later discarded in favour of 12-round trays.

Compared with the Breda the Scotti was a far simpler weapon. It resembled the Oerlikon gun in some respects, but used a different mechanism. It was much easier to manufacture than the Breda, but despite the use of a longer barrel the Scotti's overall performance appears to have been inferior to that of its contemporary. The same ammunition type (together with its super-sensitive fuse) appears to have been used, but the maximum effective ceiling was lower than that of the Breda, which indicates a different propellant charge. To balance this, against targets at low altitudes the rate of fire was slightly higher and for the benefit of the gun crew the Scotti was lighter than the other weapon.

The Scotti appears to have been used in smaller numbers than the Breda, but it was also used by other nations. Before 1940 many Scottis were sold to various South American nations, and it also appears that many made the long journey to China. After 1942 the ease of fabrication of the Scotti (compared with the more complicated Breda) led to an increase in Scotti production totals, but the type never seriously challenged the number of Bredas in service. Before 1943 many Scottis were used by German troops operating in North Africa as the **2-cm Scotti (i)**, and once the Italians had surrendered the Scotti became an established part of the German inventory for units based in Italy. It was certainly used by German units operating against the Yugoslav partisans and there seems to be enough evidence to state that after 1943 the guns were kept in production at the Isotta Fraschini facility in Turin for German use.

Two versions of the Scotti were produced. One was a semi-mobile version that could be carried on trucks and dismounted for use; once off the truck it could be manhandled on a twin-wheeled carriage, though in action the gun rested on a light flat tripod mounting. The other version was static, with the gun on a pedestal mounting. This latter version was used mostly on the Italian mainland, and after 1943 numbers of them were taken over by British troops for the local defence of coastal artillery positions. After 1945 the type was used for some years by the re-formed Italian army.

The Cannone-Mitragliera de 20/77 (Scotti) was used alongside the Breda as the standard Italian army light anti-aircraft cannon. It was longer than the Breda and could use a 60-round drum magazine, but 12-round trays could also be used. Two types were produced, one static and the other for towing by light trucks.

Specification

Scotti
Calibre: 20 mm (0.787 in)
Length of piece: 1.54 m (60.6 in)
Weight: in action 227.5 kg (502 lb)
Elevation: −10° to +85°
Traverse: 360°
Muzzle velocity: 830 m (2,723 ft) per second
Maximum effective ceiling: 2135 m (7,005 ft)
Rate of fire: (cyclic) 250 rpm
Projectile weight: 0.125 kg (0.276 lb)

ITALY

20-mm Breda

One of the two standard Italian 20-mm (0.787-in) AA guns was the weapon known to the Italian army as the **Cannone-Mitragliera da 20/65 modello 35 (Breda)**. It was first manufactured in 1934 by the Società Italiana Ernesto Breda of Brescia, a company that was no stranger to weapon production but whose staple activity was building locomotives and trucks. The Breda gun was designed as a dual-purpose weapon for use against ground and aircraft targets, and was taken into service by the Italian army in 1935.

The 20-mm Breda gun was a very effective weapon, and was much used by the Italian army. It had a rather complicated twin-wheeled carriage that could be towed into action behind a truck, but it was light enough to be manhandled over considerable distances and it could even be broken down into four pack loads for man carriage or mule transport. In action the gun required a team of three men: the aimer sat on the gun and used a complex telescopic sight incorporating a predictor function. Ammunition was fed into the gun on 12-round trays, and the feed mechanism contained the odd Italian feature of placing the spent cartridge case back into the tray once it had been fired. Exactly what function this feature was supposed to impart is uncertain, but it appeared on several Italian automatic weapons and at least had the advantage of keeping the gun position tidy.

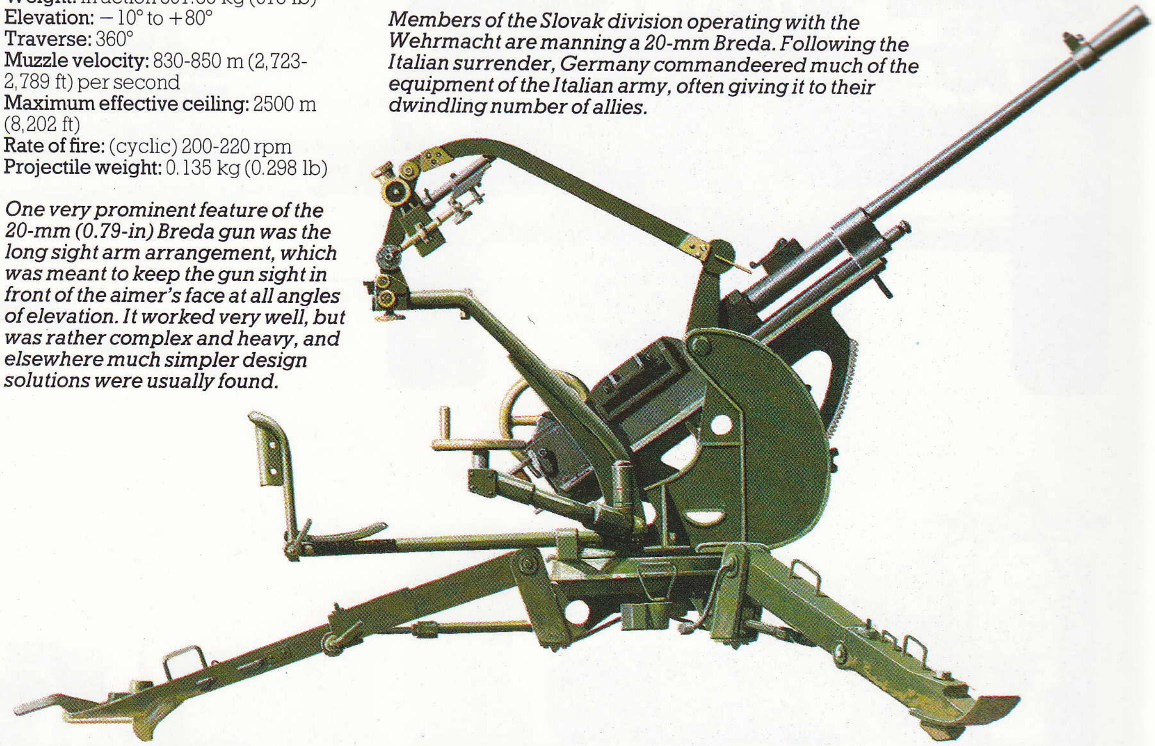
Against ground targets the gun fired armour-piercing rounds. Aircraft targets were engaged with a high explosive projectile that incorporated a very sensitive percussion fuse to operate against light aircraft structures. The projectile also had a self-destruct feature if it did not hit a target. The tripod platform of the gun provided a steady base for firing, and against aircraft the gun proved to be very successful. Against tanks it was less effective, but any weapons captured by the Allies during the North African campaigns were usually mounted on the light armoured cars of the day to provide them with more offensive capability than that provided by the usual machine-guns. The Germans also took over numbers of Breda guns for their own use in North Africa under the designation **2-cm Breda (i)**, and the Italian surrender of 1943 meant that all guns on the Italian mainland immediately changed to German use. Much farther afield, some Breda guns were also used by various of the warring Chinese military factions.

Apart from the modello 35 there was also a **modello 39**. This was a much more complex weapon: it used the same gun as before, but allied to a static pedestal-type mounting on which the gun itself was suspended below curved arms that carried the sighting system. This version was usually retained for the defence of the Italian mainland.

Specification

Breda modello 1935
Calibre: 20 mm (0.787 in)
Length of piece: 1.30 m (51.2 in)
Weight: in action 307.35 kg (678 lb)
Elevation: −10° to +80°
Traverse: 360°
Muzzle velocity: 830-850 m (2,723-2,789 ft) per second
Maximum effective ceiling: 2500 m (8,202 ft)
Rate of fire: (cyclic) 200-220 rpm
Projectile weight: 0.135 kg (0.298 lb)

Members of the Slovak division operating with the Wehrmacht are manning a 20-mm Breda. Following the Italian surrender, Germany commandeered much of the equipment of the Italian army, often giving it to their dwindling number of allies.



One very prominent feature of the 20-mm (0.79-in) Breda gun was the long sight arm arrangement, which was meant to keep the gun sight in front of the aimer's face at all angles of elevation. It worked very well, but was rather complex and heavy, and elsewhere much simpler design solutions were usually found.

SWEDEN

40-mm Bofors

The **40-mm Bofors** gun has by now passed virtually into legend as one of the most successful weapons of its type that has ever been produced, and it was used by nearly all protagonists during World War II, and a measure of its effectiveness can be seen by the fact that it is still in service to this day.

The 40-mm (1.575-in) Bofors gun had its origins in a 1928 request from the Swedish navy for AB Bofors to design a light anti-aircraft gun. The first weapon was manufactured in 1930 and was subsequently produced in single- and twin-gun mountings for the navy, and on a mobile ground mounting for the army. It was this latter version that became the most famous, for it was soon seen to be the best gun of its type available. It had a high muzzle velocity (making it an ideal anti-aircraft weapon), it fired a good-sized projectile with a worthwhile payload that could bring down virtually any aircraft that it hit, and the mounting and carriage were relatively light and handy to use in action. Within a few years orders were flooding into the AB Bofors factory at Karlskroga but, more importantly at the time, a number of foreign governments negotiated for licence production of the gun and its ammunition. These nations included Hungary, Poland, Finland, Greece, Norway and many other countries as well. Thus by 1939 the Bofors gun was in production all over Europe for many armies in a bewildering arrangement of cross-deals. For instance the United Kingdom took out a licence, but was in such a hurry to re-arm with the Bofors gun that it also purchased quantities from Poland and Hungary. France wanted to set up a line but purchased guns from Poland.

Some nations, such as Poland, incorporated their own modifications, contributing a lighter carriage (in the **40-mm armata przeciwlotnicza wz 36**) which was later adopted by the British. Progressive developments to the carriage and sights were gradually introduced, and there were many and various models of naval mountings. Some of these variations are covered separately, though the gun itself changed but little. It used a robust clip-fed mechanism in which the sequence was automatic once the gunner had pressed the trigger. As he did so a round was rammed into the breech, the breech closed and the weapon fired, the spent case being ejected ready for another round to be fed, all in a sequence that continued as long as the trigger was pressed. If the barrel became overheated it could be rapidly changed.

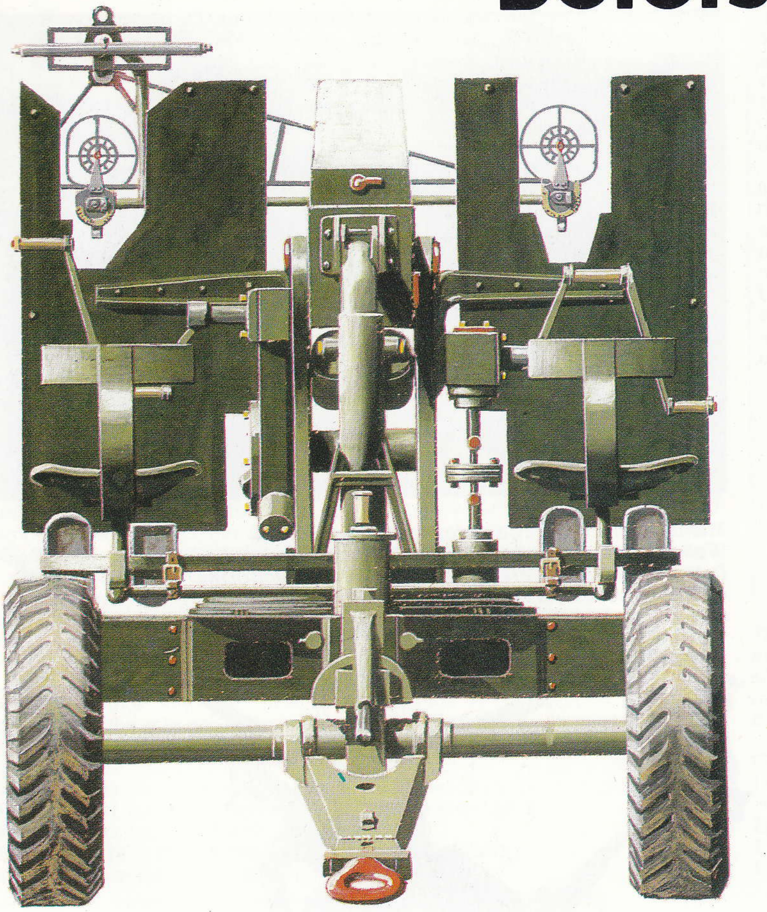
After 1940 the main centres of Bofors production were the United Kingdom (**Gun, AA, Mk 1**) and the United States, where the original Swedish design was reproduced virtually unchanged as the **40-mm Gun M1**. On the German side production was continued at the Kongsberg Arsenal in Norway for use by the German army and the Luftwaffe as the **4-cm Flak 28 (Bofors)**. In the Far East weapons captured in the Dutch East Indies were used by the Japanese. The Soviet Union received some numbers of Bofors from the Americans under Lend-Lease, so it can be seen that Bofors guns were in action on all fronts throughout the war.

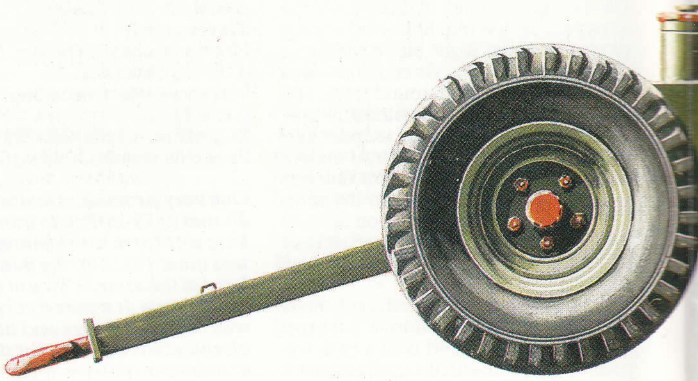
Specification

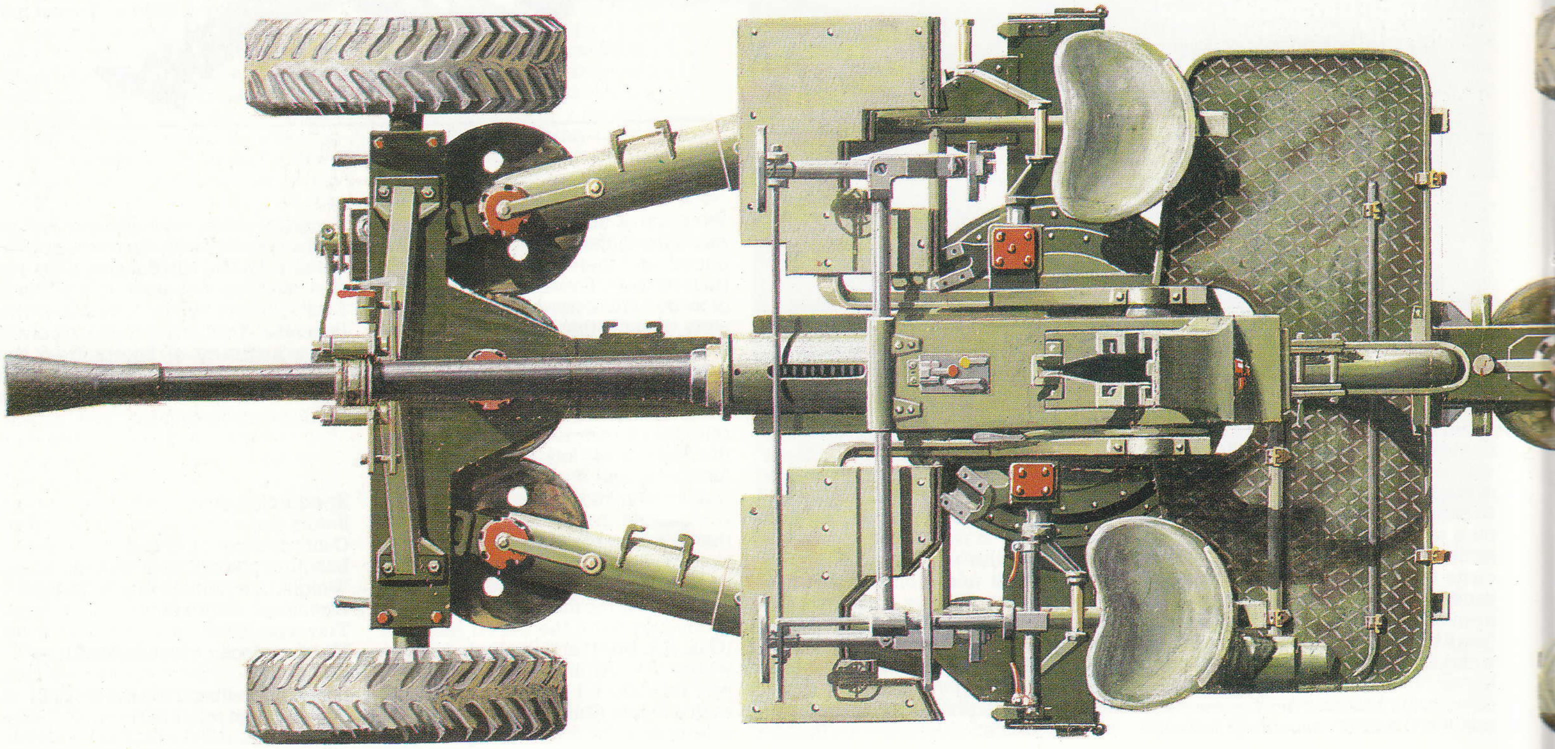
Bofors gun
Calibre: 40 mm (1.575 in)
Length of piece: 2.25 m (88.6 in)
Weight: in action 2460 kg (5,423 lb)
Elevation: −5° to +90°
Traverse: 360°
Muzzle velocity: 854 m (2,802 ft) per second
Maximum ceiling: 7200 m (23,622 ft)
Rate of fire: (cyclic) 120 rpm
Shell weight: 0.89 kg (1.96 lb)

Bofors 40-mm Gun, AA

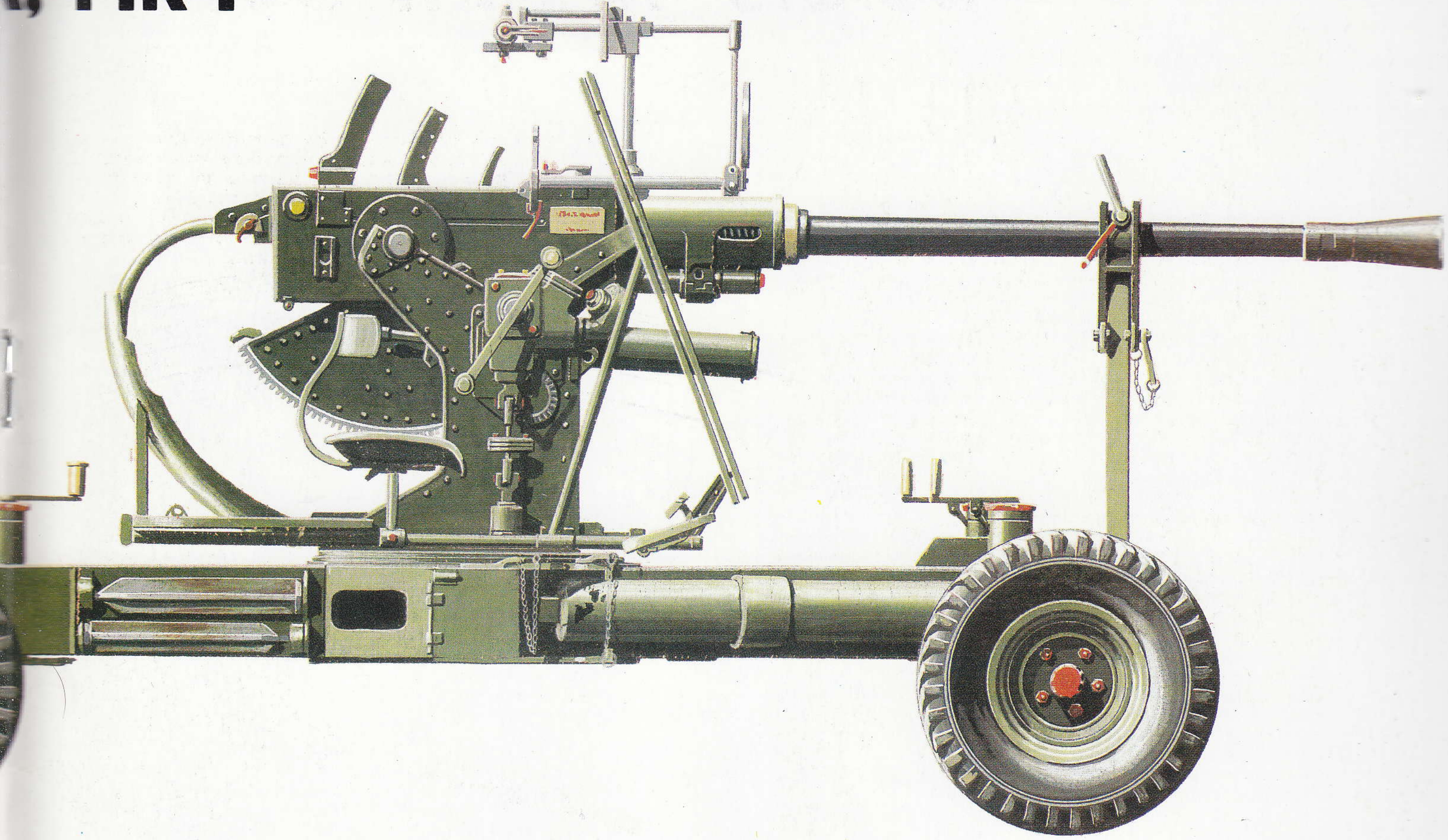
Following Polish design ideas, when Britain began licence manufacture of the Bofors it was decided to simplify construction of the mounting. The Mk 2 carriage depicted had tubular stabilizing outriggers instead of the riveted box of the original Swedish Mk I. Even today the Bofors remains in service with almost 40 countries.

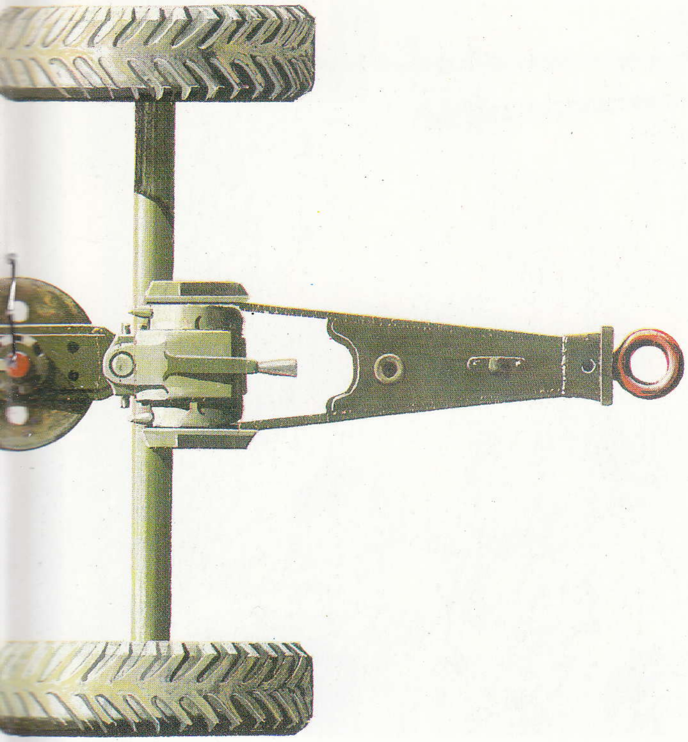


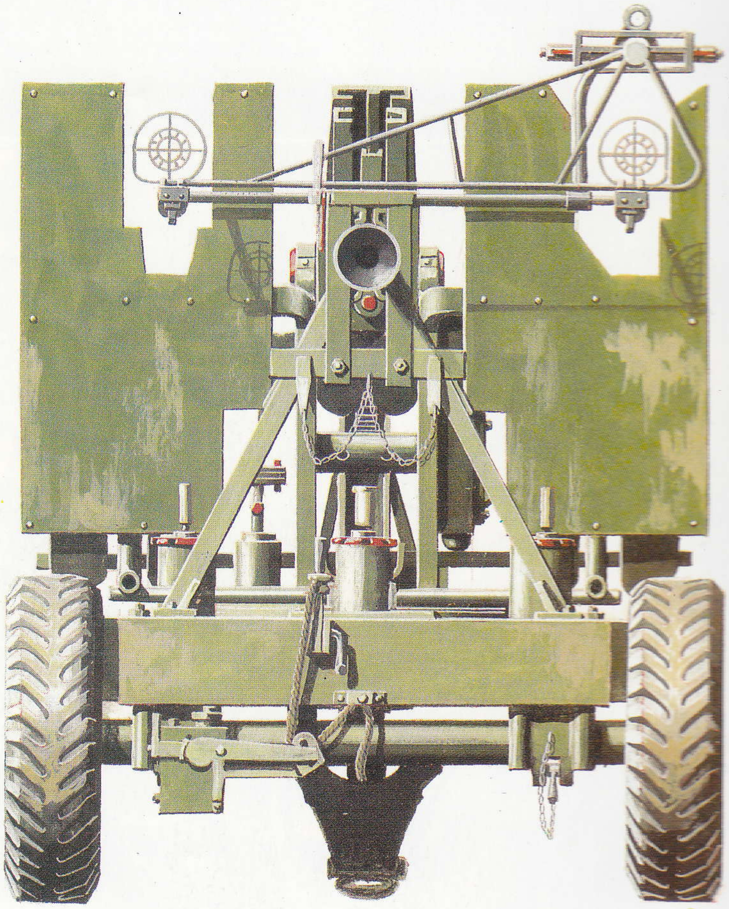




A, Mk 1







The Bofors Story

Along with the 20-mm Oerlikon, the Bofors M/36 L60 40-mm anti-aircraft gun has some claim to being an artillery classic. It is still serving worldwide after more than 50 years.

Few landing craft had any anti-aircraft weapons of their own, or crew to man them, so any units carried had to use whatever weapons they carried. Here the crew of a Bofors Gun stands ready to take on any target that appears, probably during the run-up to the June 1944 D-Day landings.

Although the first operational Bofors light AA gun model was approved for service as early as 1930, the version that is most remembered as the 'classic' form for the land-based anti-aircraft role was known to AB Bofors as the m/36 from its year of introduction, namely 1936. The m/36 was the basis from which all the other Bofors gun variants sprang, and it is also worthy of note for the fact that by then the gun design itself was 'frozen'. Later changes to the Bofors gun were almost exclusively associated with the carriage, for once the gun design was correct no further changes were necessary.

It would be as well to examine the gun itself before dealing later with its many forms of carriage. The gun used a long slender barrel that was 60 calibres long, i.e. 60 times the calibre of 40 mm (1.575 in), but this was a nominal figure. The barrel itself was designed for rapid changing when it became worn or too hot for further use after prolonged firing. This change involved the labour of a few men, but could be carried out within minutes by a trained crew. Although the land-based Bofors gun barrels were air-cooled, many naval installations, especially those made in the United States, used water-cooling jackets. Farther back on the gun what appeared to be the gun body was in fact largely the ammunition feed mechanism, for the gun itself ended only just to the rear of the point where the barrel met the 'receiver'. The breech mechanism used a vertical sliding block for obturation, the brass cartridge case of the fed round providing complete sealing. For firing a five-round clip was fed into the ammunitiion feed guides on top of the gun. Operating a lever fed one round into the feed mechanism, where it waited until the mechanical trigger was pressed, though operation of the trigger did not actually fire the gun. That was carried out automatically as part of a set sequence whereby the operation of the trigger allowed the round to be fed into the breech which then automatically closed, the round was fired and the subsequent recoil forces re-opened the breech, ejected the spent case and cocked the feed mechanism ready for the next round to be fed, and the whole gun then returned to its original position under the power of the return spring around the gun barrel. As it returned the next round was fed, and so on. All the gun crew had to do while the gun was firing was follow the target and keep topping up the ready rounds in the ammunition feed guides.

Bofors on the move

The carriage for the Bofors gun consisted of a simple turntable on a cruciform mounting. On the move the carriage was carried on two of the mounting legs that were connected to two-wheeled axles front and rear. The side mounting legs were folded upwards on the move. Getting the gun into action took only a few minutes and in an emergency it could be fired 'off the wheels', although this practice could introduce some instability at certain barrel angles and was not encouraged.

In its original m/36 form the carriage used heavy box-sections for the outrigger legs, and one of the early changes made to the carriage involved these legs. The Poles were the first to realize that they could be made simpler and considerably lighter, and soon introduced this feature onto the guns they produced at their arsenal at Starachowice. The Poles were among the first to supply completed guns to the British before 1939, and the British noted the changes they had introduced and copied them on the early versions produced in the United Kingdom. But even with these changes the British later decided to go one better, and in place of the box section girders introduced tubular steel struts which required no riveting or welding, and which were also much lighter than the legs of the Polish version. This 'tubular' version later became the British

Dug in to protect a river crossing in Italy, an M1 40-mm gun crew stands ready for action, with the top round of the five-round clip just visible above the breech. At 120 rounds per minute the clip would take two and a half seconds to fire.

standard version of the carriage as the Platform Mk 2. But since production facilities for the box-section carriages existed these were kept in use and production until well after 1945. The Americans did not introduce any major changes to the original Swedish carriage design, and retained the type in manufacture right through the war, no doubt thinking that production totals were more important than design detail changes. The Americans knew the Bofors gun as the 40-mm Gun M1.

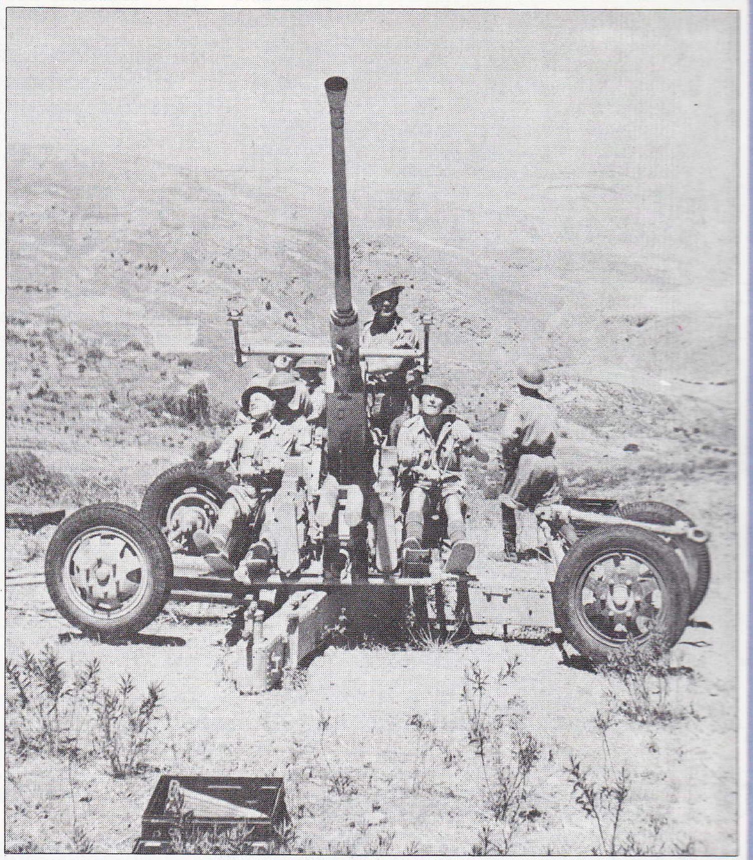
However, the Americans did produce a lightweight version known as the M5. This was only one of several attempts by gun and carriage designers in different countries to produce a light version for use by airborne forces or in theatres of war such as Burma, where any improvements in portability or reduction of overall size meant a great increase in mobility. One of these was developed for Indian Army use only. The Canadians produced a very small carriage that travelled on a single axle and was known as the Bantam. The American M5 was so designed that it could be carried in a Douglas C-47 (Dakota), but some stripping down of the gun equipment had to be carried out before this could be done properly.

Self-propelled Bofors

Mobility of another kind came when the Bofors gun was placed on self-propelled carriages. The British put two such equipments into service, one being the mounting of a single gun on the hull of obsolete Crusader tanks and the other a much simpler conversion of Morris-Commercial or Ford 4×4 trucks. The latter was one of the most prolific British self-propelled anti-aircraft weapons, and was widely used. The Americans, however, by far exceeded the British in the number of experiments they made. Various forms of tank and halftrack chassis were used for trials of all kinds, some of them bordering on the bizarre. For instance, there was a halftrack mounting known as the T59 with two Bofors guns, one above the other. This combination was too much for the vehicle and it was grossly overloaded. In the end the Americans produced only one service weapon mounting the Bofors. This was the M19, a twin-barrelled mounting on the hull of an M24 light tank which entered service in mid-1944.

On the Axis side of the fence, the Bofors gun underwent some considerable changes at the hands of the Hungarians. Their major contribution to the Bofors gun was in the sighting arrangements, for they introduced an early form of optical predictor sight that operated electrically. Target speed and height information, along with some other data, were fed into the sight before an engagement, and the sight then predicted the target's future path and off-set the gunner's aim accordingly. The Americans and British introduced the far more bulky Kerrison Predictor for the same purpose, but this was a centralized equipment that could transmit data to the guns, a course of action that led in time to entire batteries of Bofors guns being operated under remote control from a central position, the gun crews simply feeding in the ammunition.

But it was left to the Hungarians to churn out what must have been the most unusual version of the Bofors gun used during World War II. They made their guns at the Stratisbitkerna, part of the Hungarian state railway concern, and in 1943 produced a version of the gun that was carried in Hungarian air force Messerschmitt Me 210s. This variant was produced only in small numbers, but was used with considerable success by Hungarian pilots as 'tank busters'. Unfortunately, few details of this interesting use of the Bofors gun have survived the war.



Above: A Bofors 40-mm (1.575-in) Gun is seen in action during the brief Syrian campaign of 1941. The gun is an early model with no crew protection and simple sights, items that were altered later in the production run. Note the open ammunition box in the foreground and the wheels and axles still on the carriage.

Below: When the expected aircraft targets failed to appear after the 1944 Normandy landing, many anti-aircraft weapons were used in other roles. Here a Bofors gun appears to be in use as a tank ambush weapon amid the ruins of Caumont, on 10 July 1944.

FRANCE

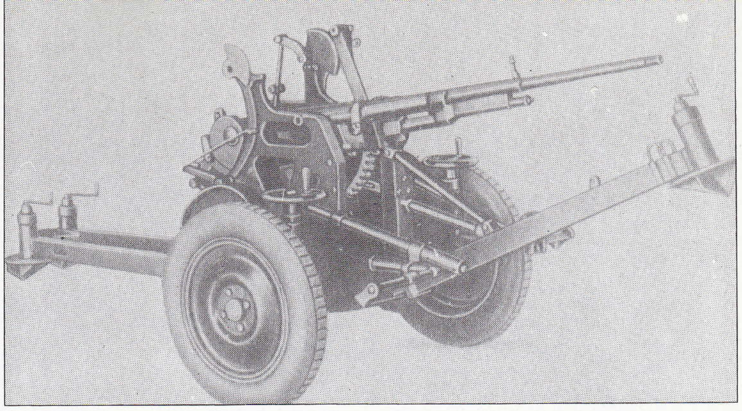
25-mm Hotchkiss

Between the world wars the French army retained great weapon stockpiles from World War I, and with them a military philosophy that dealt only in terms of World War I battles. Thus when it came to considerations of anti-aircraft weapons it was decided that an updated '75' (the famous 75-mm/2.95 in Model 1897) was all that was required, and that a new 12.7-mm (0.5-in) heavy machine-gun would suffice for low-level defences. The French armaments manufacturers, including Hotchkiss, thought otherwise and in 1932 brought out a new 25-mm (0.98-in) automatic weapon and presented it to the military authorities.

The response was negative. The staff planners saw no need for a weapon such as the **25-mm Hotchkiss** and were unwilling to consider the type. They did agree to carry out trials with the new gun, but that was all and by the mid-1930s it appeared that the project was defunct. Then came the Spanish Civil War, and French military observers on the spot soon noted that there most definitely existed a requirement for a weapon heavier than machine-guns to counter the activities of ground-attack aircraft. Thus there was a rushed order to Hotchkiss for large numbers of its 25-mm weapon. But this order was beset with uncertainties regarding rates of fire, type of carriage and so on. It was late 1938 before the order was finally sorted out and by then things had got a bit out of hand, for Hotchkiss had already started production of a model for Romania and the French order meant changes to the design and the production line. But eventually the guns started to flow from the factory.

There were two types of 25-mm Hotchkiss. One was the **Mitrailleuse de 25mm sur affut universel Hotchkiss Modèle 1938**, which was a light weapon transported on a single-axle carriage; the other was the **Hotchkiss modèle 1939**, which was a heavier weapon intended for static use but capable of being moved if required. Both were basically simple and adequate weapons with a high rate of fire and good ammunition that was also intended for use against ground targets if the opportunity arose. Thus an armour-piercing projectile was available. A version for use by the French navy was produced using a pedestal mounting, and just before the Germans invaded France in May 1940 Hotchkiss produced a twin-barrelled variant known as the **Hotchkiss modèle 1940**, which did not get past the initial trials stage.

The main problem for the French army was that the Hotchkiss production lines could not churn out the guns in sufficient numbers. Despite wartime urgency, the Hotchkiss works were beset by industrial troubles and other delays to the extent that when the Germans invaded France only just over 1,000 Hotchkiss guns were in service, which was way below the numbers required. In the event those that were produced mainly fell into the hands of the Germans. Some were retained by the Vichy French armed forces and some used by the Free French in the Middle East, but the bulk that survived May 1940 were impressed into German use and issued to various units based in France; some were later incorporated into the Atlantic Wall beach defences. The German designations were **2.5-cm Flak Hotchkiss 38** and **2.5-cm Flak Hotchkiss 39**.



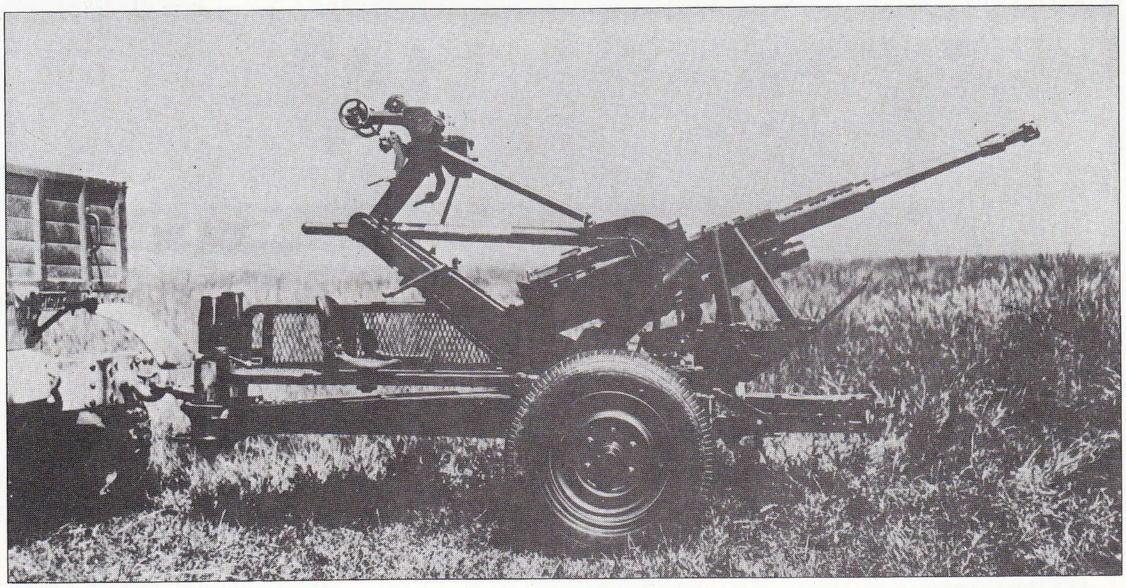
There are two main models of the 25-mm (0.98-in) Hotchkiss cannon; this is the mle 38 ready for towing, but minus the usual muzzle flash-hider. Other versions used differing barrel and sighting arrangements.

Specification

Hotchkiss modèle 38
Calibre: 25 mm (0.98 in)
Length of piece: 1.50 m (59 in)
Weight: in action 850 kg (1,874 lb)
Elevation: −5° to +80°
Traverse: 360°
Muzzle velocity: 900 m (2,953 ft) per second
Maximum effective ceiling: 3000 m (9,843 ft)
Rate of fire: (cyclic) 350 rpm
Projectile weight: 0.29 kg (0.64 lb)

FRANCE

37-mm Schneider



Only a few (some sources say 20) of the 37-mm (1.457-in) Schneider guns were produced for the French army, as the weapon was originally produced for export. It was passed over in favour of the Swedish Bofors Gun after 1938.

The **37-mm Schneider** gun was produced initially during the early 1930s, and was at the time rejected by the French army which could then see no reason for obtaining such a weapon. A similar Hotchkiss proposal met with the same response. The Schneider concern decided to go ahead with development of the design under its own auspices, and in time these efforts were rewarded by a number of export orders from nations such as Romania. More were taken by the French navy, but the numbers involved were never large.

The Spanish Civil War changed French official thinking to a radical degree: it was now clear that the bulk of the anti-aircraft weapons used by the French armed forces were at best obsolescent or, in the case of low-level defence weapons, ineffective. Accordingly large production orders were placed for weapons initially to supplement and eventually to replace existing stocks. But in the case of the 37-mm guns the French staff planners were in something of a quandary, for they had nothing in what they came to regard as the medium-calibre bracket. At the bottom end 12.7-mm (0.5-in) and 25-mm (0.98-in) weapons were selected, and at the upper end of the weapon bracket the old '75s' (75-mm/2.95-in) weapons were being updated and new designs were in prospect: but there was nothing in the medium bracket and so a rushed procurement programme was established.

The Schneider 37-mm gun was an immediate candidate for selection, but at the same time it was appreciated that it was not a very satisfactory weapon. The gun itself had a rather short barrel (resulting in a lack of range and power) and the ammunition was also not particularly powerful. Moreover it was considered that the carriage was too heavy and awkward, and took too long to get into action. Thus although the Schneider gun was ordered as the **Mitrailleur de 37 mm Schneider modèle 1930**, it was only ordered in parallel with the Swedish 40-mm (1.575-in) Bofors from Poland. An order for 700 Schneider guns was placed, with deliveries hopefully extending into 1941. In the event only some 20 had been produced by the time the Germans invaded; this handful was emplaced around Paris and thus never got a chance to take any part in the events of May and June 1940.

This delay in delivery was caused mainly by production and other troubles at the Schneider factories. The 37-mm gun was not easy to manufacture, and it took time to establish the production facilities. In fact things got so far behind schedule that by early 1940 the French army planners actually approached the United States and requested large numbers of Colt 37-mm anti-aircraft guns. Nothing came of this venture before the Germans invaded.

Thus the Schneider 37-mm gun faded from the scene. The numbers taken over by the Germans were too small to be considered for the usual inclusion in the German inventory, and by the time 1945 came around they had all apparently vanished into the scrap furnaces. Thus the Schneider gun may be regarded as one of World War II's least successful weapons.

Specification

Schneider modèle 1930
Calibre: 37 mm (1.45 in)
Length of piece: not recorded
Weight: in action 1340 kg (2,954 lb)
Elevation: −0° to +80°
Traverse: 360°
Muzzle velocity: 800 m (2,625 ft) per second
Maximum effective ceiling: 3000 m (9,843 ft)
Rate of fire: (cyclic) 175 rpm
Projectile weight: about 0.55 kg (1.21 lb)

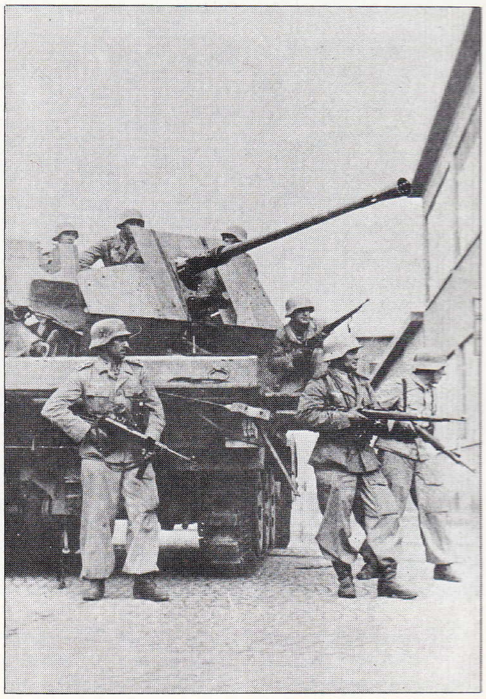
Flak Artillerie!

Trained to operate closely with tactical aircraft, the Wehrmacht was well aware of the value of an efficient anti-aircraft defence. In spite of the political interference endemic in the Third Reich, when war came German arms were more effectively shielded from air attack than any other.

When the German army started to re-equip during the early 1930s, the light flak arm was entirely new. Nothing similar to it had been part of the German army during and after World War I, so it had to be built up from scratch, working out its own internal arrangements and its own operational policies. Unfortunately this had to be done within the extremely odd and factional structure of the political realities within Nazi Germany. One of the basic tenets of the Third Reich's political structure was that no single organization could have sole control of any particular state activity or function. Thus the police force had to have a civil and a party organization, and even down to operational matters such as light anti-aircraft defence the responsibilities had to be split. So as the German army was re-arming for its new air-defence role, the Luftwaffe was also busy doing exactly the same. There was supposed to be a division of responsibilities between the army and the Luftwaffe in that the army light flak formations were intended for the defence of the field armies against attack, while the Luftwaffe's responsibility was supposed to be the defence of the Reich itself. What actually happened was that there developed many areas where responsibilities overlapped and became confused. For instance, was a light flak unit defending its home barracks inside Germany to come under army or Luftwaffe control? Such arguments abounded, and reflected not only on the control of light flak organizations but even down to matters such as the procurement of weapons and equipment as they left the factories. Despite the imposition of rigid quotas by high command levels, new equipment was frequently the cause of interservice squabbles, and these grew in number and acrimony with increases in the number of Waffen-SS units in the field.

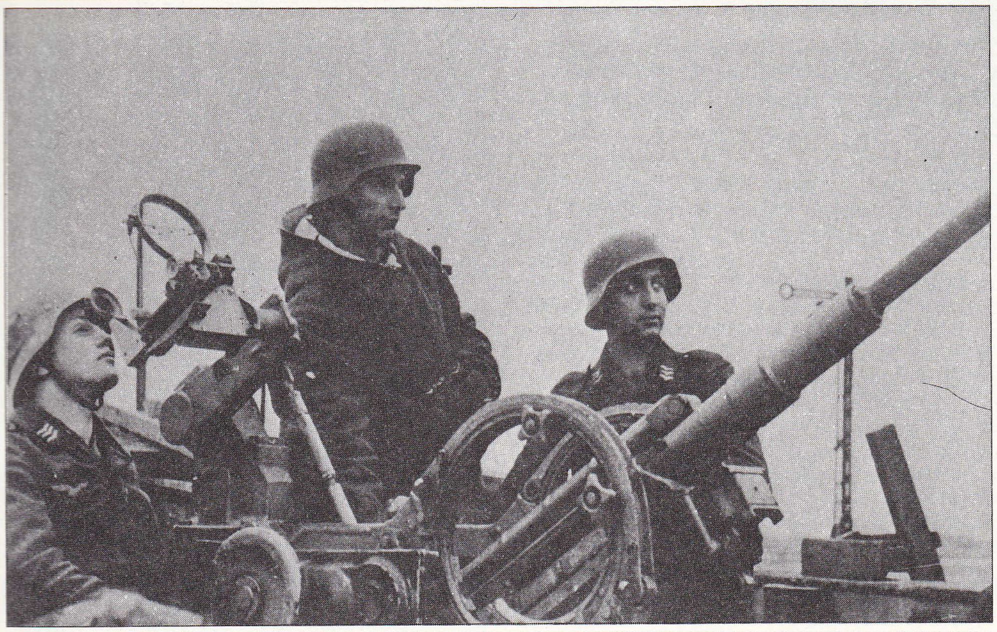
Many of these interservice squabbles were never cleared up, and as the German war situation deteriorated they generally grew in quantity and severity rather than died away. Thus when dealing with such matters as the organization and equipment of light flak units it would be as well to remember that the 'perfect case' examples provided were often not achieved in reality. A unit bound for the field would often find its equipment or ammunition 'hijacked' by another arm, despite the obvious results in many cases. In general the army tended to be at the bottom of the pile when equipment allocations were being considered, and thus although a certain army field unit was supposed to be equipped with halftrack tractors for its guns, it was frequently issued with impressed French civilian trucks or something similar. Some units on the Eastern Front often had to use animals to tow their guns into action when fuel ran out. Thus the picture of a super-efficient German war machine was not always borne out in reality.

Despite their many differences in policy and priorities, the German army and the Luftwaffe generally organized themselves along similar lines as far as the light flak units were concerned. Although the bulk of this section will deal with the German Army, Luftwaffe units were very similar in most respects, although inevitably there were some differences. Later the Waffen-SS also tended to organize itself along army lines.



A mittlerer Zugkraftwagen 8t half-track mounting a 3.7 cm (1.457 in) Flak 36 guards an Italian bridge during September 1943. Some of these Flak 36-armed half tracks had armoured cabs for the driver and towed a trailer carrying extra ammunition for the main gun.

This early example of a mittlerer Zugkraftwagen 8t carries a 2-cm (0.79-in) Flakavierling 38 somewhere deep in the Soviet Union during late 1941. This vehicle is towing a trailer that not only carried extra ammunition but also carried the crew's kit and day-to-day supplies, as well as extra fuel for the vehicle.



A Luftwaffe crew mans a 2-cm (0.79-in) Flak 38 during the last days of the war in March 1945. The ring-type gun mounting was one of the main points that distinguished the Flak 38 from the earlier Flak 30, which did not have this feature although the guns could be mounted on either carriage if required. Note the simple sight in use in 1945.

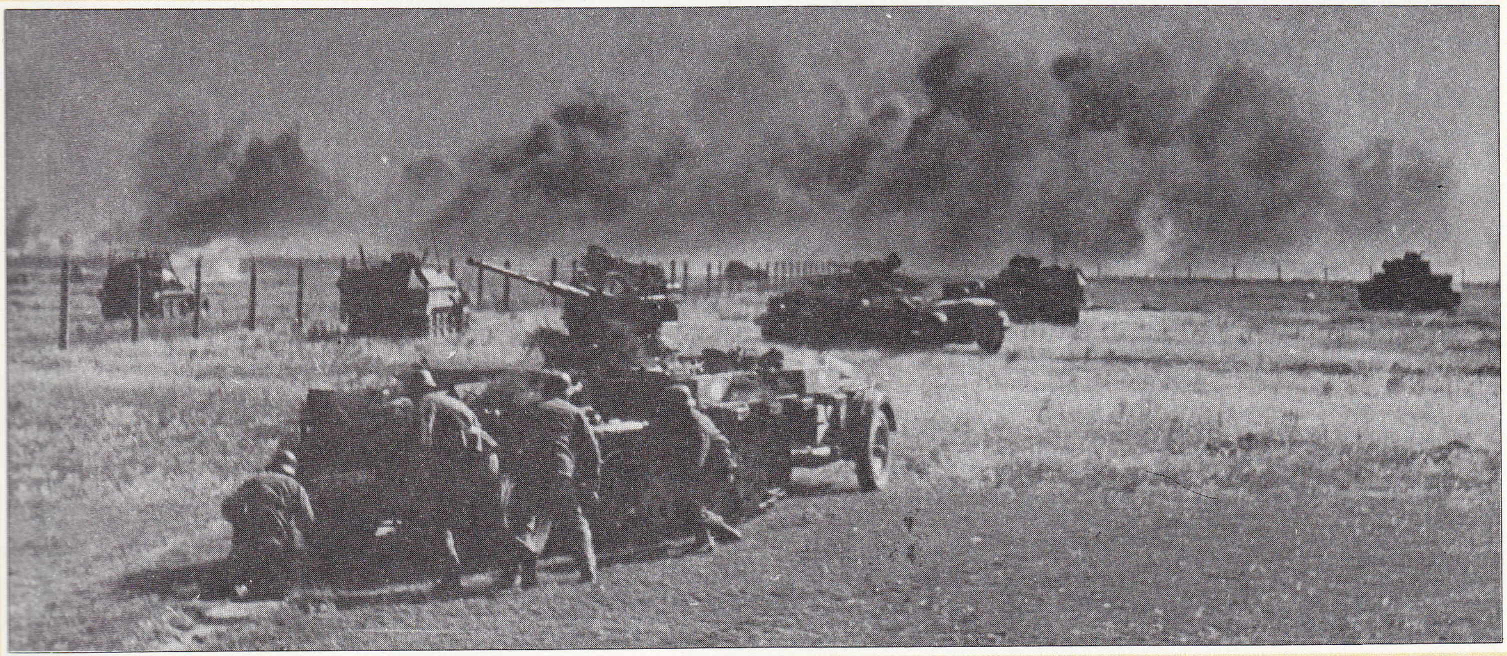
In broad terms, German army light flak units were divided into two main types, motorized and non-motorized. The non-motorized units were intended mainly for the defence of rear areas and static emplacements such as barracks and stores dumps. They did have a measure of mobility and were allocated some transport, but this was frequently withdrawn from them for other purposes. In contrast the motorized units were intended to move into the field with major formations and were equipped accordingly. The transport equipment, if one believes the many war-time accounts of these units, was meant to comprise halftracks, though in practice trucks of various kinds were far more common.

The field unit most generally used at high levels of command was the *Flakregiment*. This could take a number of forms, comprising either three mixed *Flakabteilungen* (battalions) or a mix of two *schwere Flakabteilungen* (heavy battalions) and three *leichte Flakabteilungen* (light battalions). The mixed formation was the more common as it provided commanders with greater flexibility and enhanced capability. Some of these mixed *Abteilungen* had as many as three heavy batteries (armed with the famous 88-mm/3.46-in Flak 18 or 36) and three light batteries (one of them equipped with the Flakvierling 38). Such an *Abteilung* had a manpower strength of 1,350 officers and men, 339 motor vehicles, 38 motorcycles, 12 searchlights, 12 88-mm weapons and 48 light flak weapons.

However, there were *leichte Flakabteilungen* made up entirely of light flak batteries. These were much smaller than the mixed formations, having only three light flak batteries and a manpower strength of 800 officers and men. These light groupings were quite common and required far less logistic support than the larger formations as they had their own integral supply system that travelled with the *Abteilung* when it went into the field, carrying not only ammunition, food and other supplies but also a small light aid detachment that maintained the guns and vehicles using a small field workshop; mixed *Abteilungen* also had this function but mainly devoted to the heavy batteries.

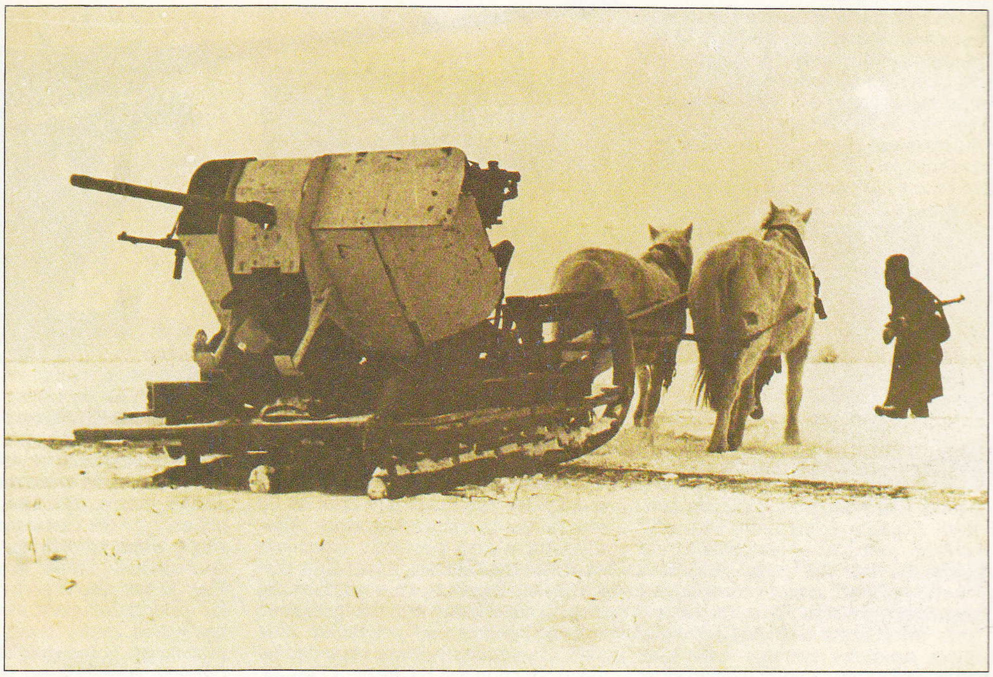
Such a *leichte Flakabteilung* was headed by a battalion headquarters and command platoon. The headquarters contained mainly the administrative staff responsible for the day-to-day supply and other routine functions that allowed the rest of the battalion to get on with its combat tasks. The command platoon was the home of the battalion commander plus his immediate staff and signallers. The command platoon was responsible for its own defence, but had no flak weapons other than the odd one that might be awaiting issue or being passed to the rear for repairs.

Each of the three batteries had four sections. In theory, after 1941 or 1942, one of the four sections was equipped with the Flakvierling 38 and the other three with the single-barrel Flak 30 or 38. Each of the sections had three guns. In manpower terms each battery had six officers and 65 NCOs, while other ranks were supposed to be at a level of 139. In practice such manpower levels were rarely achieved, the demands of the Eastern Front being such that nearly all army units were constantly combed for manpower to make up new formations or replace casualties. The same went for equipment: each battery was supposed to have 58 motor vehicles and five motorcycles, but in practice had far less than this. The overall shortage of motor transport proved one of the Ger-



This light half-track mounts a 2-cm (0.79-in) Flak 38, and was known as the leichte Selbsfahrlafette SdKfz 10/4, using the chassis of the 1 ton half-track SdKfz 10 series. This example is seen during the German drive on Stalingrad in the summer of 1942, and is towing an ammunition trailer.

Not all the German army units were able to move on wheels or tracks, and in winter the sledge came into its own, seen here towed by two sturdy little Russian ponies. Improvisations such as this were commonplace when the Eastern Front winters set in, for the fighting did not cease even under extreme conditions.

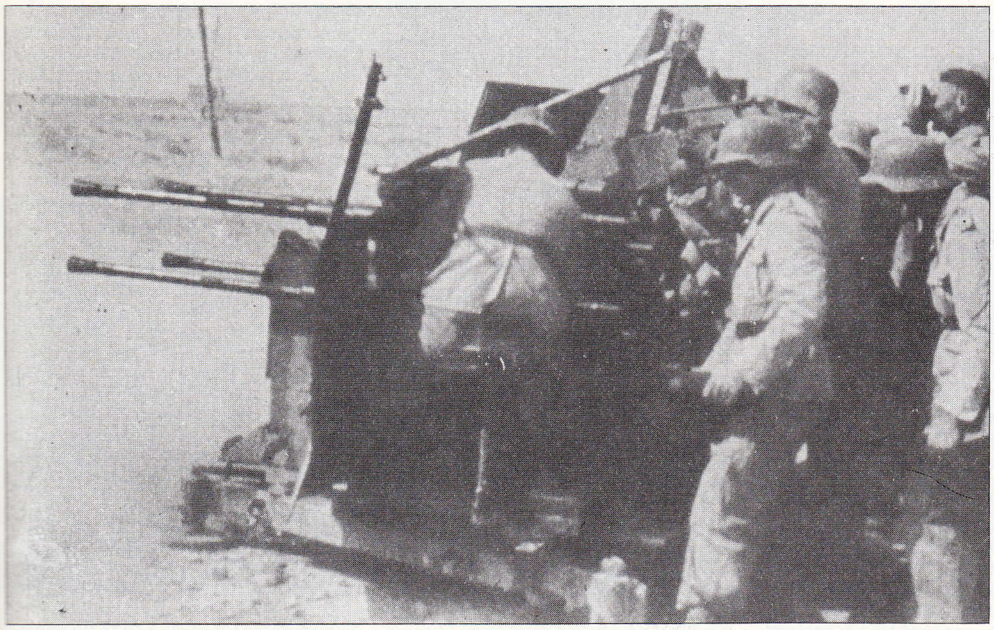


man army's major tactical and operational weaknesses.

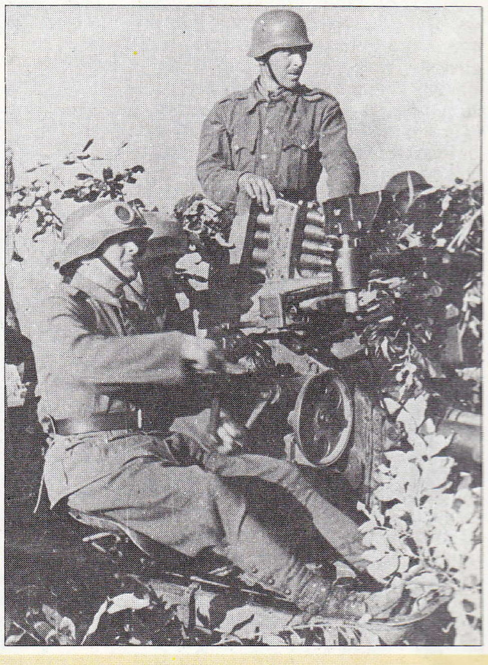
The logistic supply system was based on a column of vehicles that carried the battalion's ammunition reserves, spare parts, food and other day-to-day supplies. Workshop vehicles were there to keep the guns and the vehicles functioning, and in overall terms this integral supply column enabled the light flak batteries to remain in the field without support for some days before replenishment was required. As with the headquarters, this unit had no flak guns of its own although it was not unknown for guns being maintained or repaired to be rushed into action by the workshop fitters when an emergency arose.

The men of the light flak units obtained their initial training at various schools scattered around Germany. Some of these schools were up on the Baltic coast, which allowed virtually unlimited firing across the open sea, usually against banner targets towed by ancient Luftwaffe biplanes or light trainer aircraft. Flares fired from mortars were another common target. Many of the flak schools used somewhat ancient equipment, for the more modern weapons were in constant demand by front-line units. Thus many flak crews trained on the old Oerlikon 2-cm (0.787-in) Flak 28 or 29, guns that had been purchased during the early days of German re-armament to get something into the troops' hand quickly. Conversion to the Flak 30 or 38 was frequently made at operational-battery level. But throughout training the main accent was on teamwork, especially with the ammunition numbers who had to be adept at changing each gun's box magazines quickly as soon as the old one on the gun was empty. Refilling these magazines was another gun crew task, usually carried out with a special lever-operated loading device. The most skilled personnel on the gun were the aimer and the rangefinder, but as time went on the rangefinder with his hand-held stereoscopic rangefinder became less important. Aimers found that the tracer elements of the projectiles afforded them a much better indication of range than the rangefinder's shouted instructions, and by mid-1944 the rangefinder was no longer an official part of the gun complement. But the gun commander remained: the aimer could only lay and fire the gun under his command.

Getting the guns into and out of action was a relatively easy task. Apart from their small size and low weight, the Flak 30 and Flak 38 were carried inside the confines of a tubular steel trailer that was designed so that it could lower the gun to the ground and pick it up again afterwards with a minimum of physical effort from the crew. Once in place the gun rested on a low flat platform that could be accurately levelled by small adjustable feet. At times garrison units made their own local modifications to suit particular requirements, and an instance of this occurred in the Channel Islands: a local commander decided that he needed more anti-tank weapons and converted a Flak 30 gun so that it could fit onto a low, light anti-tank rifle mounting. Units on the Eastern Front sometimes placed their guns on sledges during the winter months. But these were exceptions.



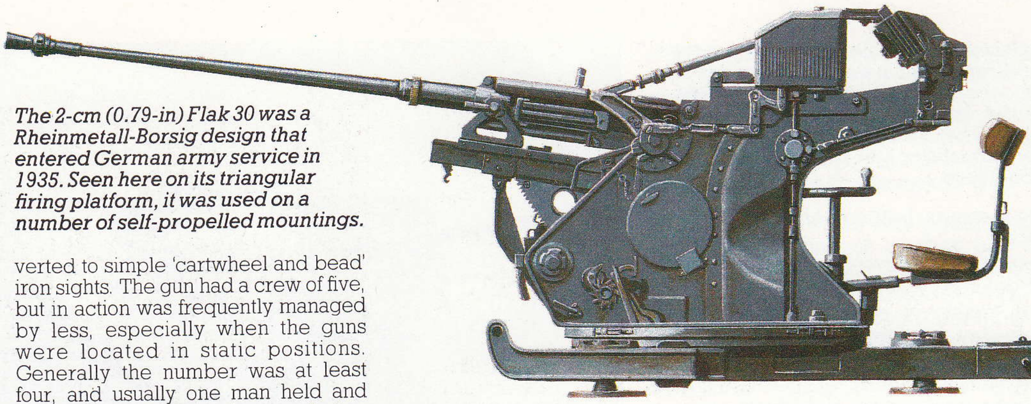
The 2-cm (0.79-in) Flakvierling 38 was often used as an anti-tank weapon, and is shown here in action with the Afrika Korps. Although of limited use against tanks, it was very effective against soft-skin vehicles and light armoured vehicles such as most armoured cars and artillery tractors (and their guns).



A 3.7-cm (1.45-in) Flak 36 is seen in action with the loader feeding into the gun six-round clips that could be joined together to produce longer, uninterrupted bursts of fire. The gun is heavily camouflaged by branches, but once in action such concealment was soon blown away by blast from the muzzle.

GERMANY

2-cm Flak 30



The 2-cm (0.79-in) Flak 30 was a Rheinmetall-Borsig design that entered German army service in 1935. Seen here on its triangular firing platform, it was used on a number of self-propelled mountings.

By the time the new German army was ready to re-arm during the early 1930s, the German armament manufacturers had built up a considerable degree of expertise in heavy automatic weapons. This was especially true of the giant Rheinmetall-Borsig concern, and accordingly it was given a contract to produce a light anti-aircraft gun with a calibre of 20 mm (0.787 in), and this was ready for service by 1935. Known as the **2-cm Flak 30**, the term Flak standing for *Fliegerabwehrkanone* (anti-aircraft gun), this light weapon was of the type often known as a cannon, and was the first of a series of weapons that were to become dreaded by low-flying Allied aircraft crews.

The Flak 30 was for its light calibre a rather complex weapon mounted on a carriage that could be towed on two wheels and in action rested on a ground platform. This platform provided a stable firing base with 360° traverse, and had a seat behind the gun for the firer who used, in the Flak 30's original form, a rather complicated form of reflector sight. These sights became even more complicated when simple predictor systems were built into it, and at one point the small sight had reached a state when it had to be driven by clockwork. In fact they got so complicated that the whole idea was dropped and later versions reverted to simple 'cartwheel and bead' iron sights. The gun had a crew of five, but in action was frequently managed by less, especially when the guns were located in static positions. Generally the number was at least four, and usually one man held and operated a stereoscopic rangefinder, though after 1944 this function was deleted as it was found to be operationally unnecessary.

Ammunition was fed into the gun in 20-round magazines, but for some never-fully determined reason the Flak 30 was prone to ammunition jams. Also, although it was perfectly adequate when first introduced, it was later discovered that its rate of fire was too slow to cope adequately with the increased aircraft speeds that prevailed after 1940. Consequently it was replaced on the production line by the later Flak 38, but those already in service were not replaced until they became worn out or were lost to enemy action.

In army light anti-aircraft *Abteilungen* (battalions) there were usually three 2-cm batteries to one 3.7-cm (1.457-in) battery, but as the war continued there were many variations on this theme. The Flak 30 was used not only by the Germans. Before 1939 some were sold to the Netherlands and even to China. In Germany the Flak 30 was also used by the Luftwaffe for ground defences, and the German navy had many specialized naval mountings. Some saw service for the defence of armoured trains, and the weapon was one of those mounted on several types of halftracks or trucks for the defence of mobile formations and convoys. The Flak 30 was frequently used in the ground target role, and there was even a special armour-piercing round for use against tanks.

Specification

Flak 30

Calibre: 20 mm (0.787 in)

Length of piece: 2.30 m (90.6 in)

Weight: in action 450 kg (992 lb)

Elevation: −12° to +90°

Traverse: 360°

Muzzle velocity: 900 m (2,953 ft) per second

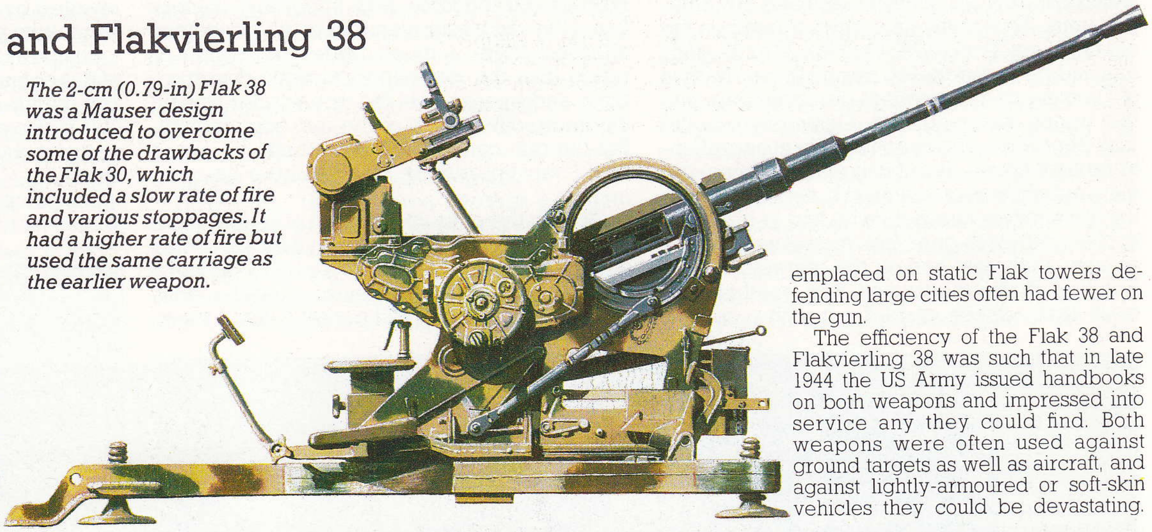
Maximum effective ceiling: 2200 m (7,218 ft)

Rate of fire: (cyclic) 280 rmp

Projectile weight: 0.119 kg (0.262 lb)

GERMANY

2-cm Flak 38 and Flakvierling 38



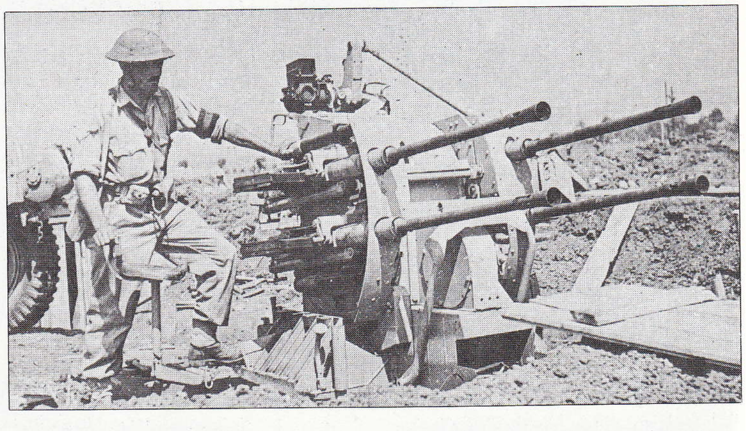
The 2-cm (0.79-in) Flak 38 was a Mauser design introduced to overcome some of the drawbacks of the Flak 30, which included a slow rate of fire and various stoppages. It had a higher rate of fire but used the same carriage as the earlier weapon.

By 1940 it was already appreciated that the low rate of fire of the 2-cm (0.787-in) Flak 30 was too low for future target speeds, so it was decided to increase the rate of fire in order to increase the possible numbers of projectiles hitting the target. It was also decided to redesign the gun to get rid of the inherent jamming problem. Rheinmetall-Borsig was not given the contract for this project. It went instead to Mauser, who came up with a new gun that was outwardly similar to the Flak 30 but internally much was changed to provide a cyclic rate of fire of 420 to 480 rounds per minute. The ammunition, feed system and most of the carriage remained much the same as before. So did the complicated sights which were later simplified, as on the Flak 30.

The **2-cm Flak 38**, as the Mauser design was known, entered service in late 1940 and eventually replaced the Flak 30 on the production lines. It served alongside the Flak 30 and was also used by the Luftwaffe and the German navy. There was even a special version for use by the German army's mountain units that could be broken down into pack loads. This used the same gun as the Flak 38, but the carriage was much smaller and lighter: it was known as the **2-cm Gebirgsflak 38** and was intended to be a dual-purpose weapon for use against ground targets as well as against aircraft.

By 1940 it was appreciated that aircraft targets were not only getting faster but also heavier and better protected against ground and air fire. Undertaken with typical German thoroughness, operational analysis revealed that although the high rate of fire of the Flak 38 was more likely to ensure a target hit, the low explosive payload of the projectile was unlikely to inflict enough damage to ensure a 'kill'. The only easy and immediate way to remedy this was to increase the number of barrels firing from one mounting, and thus the **2-cm Flakvierling 38** was developed. This was simply a single Flak 38 carriage modified to accommodate four barrels capable of firing at once. This combination became a dreaded aircraft-killer that constantly drew a toll of low-flying Allied aircraft right until the end of the war. The first such equipments entered service in late 1940 and there were never enough of them. They were used by the German army, the Luftwaffe and the navy, and many self-propelled mountings were improvized or produced to make them more mobile. There was a special version for use on armoured trains and at one point there was even a radar-controlled version under development. The Flakvierling required a greater number of men to serve it in action (usually six or seven), but those emplaced on static Flak towers defending large cities often had fewer on the gun.

The efficiency of the Flak 38 and Flakvierling 38 was such that in late 1944 the US Army issued handbooks on both weapons and impressed into service any they could find. Both weapons were often used against ground targets as well as aircraft, and against lightly-armoured or soft-skin vehicles they could be devastating.



A British soldier examines a captured 2-cm (0.79-in) Flakvierling 38. The arrangement of the four barrels can be clearly seen, and the reflector sight is prominent. The curved box magazines can be seen protruding from the guns, and it was these magazines with their 20-round capacity that limited the fire rate of the guns.

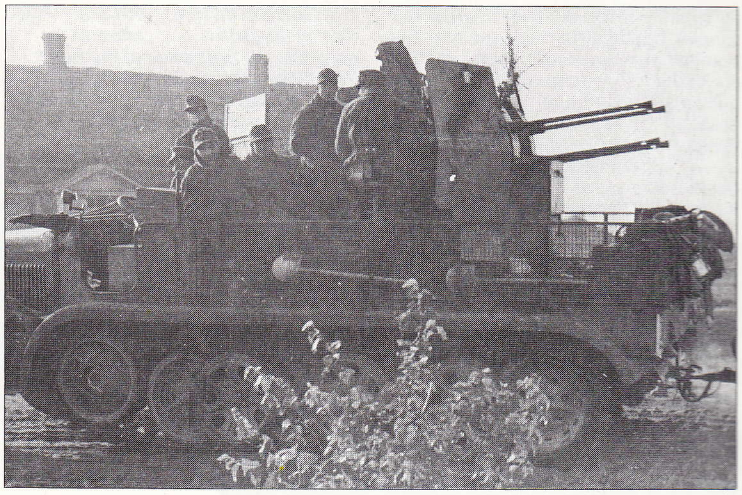
For the Germans there were never enough of them and throughout the Reich many production facilities were devoted to manufacture of the guns, their carriages and ammunition. This last was produced in several forms including high explosive (HE), high explosive with tracer and various forms of armour-piercing.

Specification

Flak 38
Calibre: 20 mm (0.787 in)
Length of piece: 2.2525 m (88.7 in)
Weight: in action 420 kg (926 lb)
Elevation: –20° to +90°
Traverse: 360°
Muzzle velocity: 900 m (2,953 ft) per second
Maximum effective ceiling: 2200 m (7,218 ft)
Rate of fire: (cyclic) 420-480 rpm
Projectile weight: 0.119 kg (0.262 lb)

Specification

Flakvierling 38
Calibre: 20 mm (0.787 in)
Length of piece: 2.2525 m (88.7 in)
Weight: in action 1514 kg (3,338 lb)
Elevation: –10° to +100°
Traverse: 360°
Muzzle velocity: 900 m (2,953 ft) per second
Maximum effective ceiling: 2200 m (7,218 ft)
Rate of fire: (cyclic) 1,800 rpm
Projectile weight: 0.119 kg (0.262 lb)



A 2-cm (0.79-in) Flakvierling 38 is mounted on a SdKfz 7/1 half track with the crew ready for immediate action. This conversion was first produced during late 1941 and was widely used, not only against aircraft but also against tank targets. This vehicle had a crew of 10 men.

GERMANY

3.7-cm Flak 18, 36 and 37

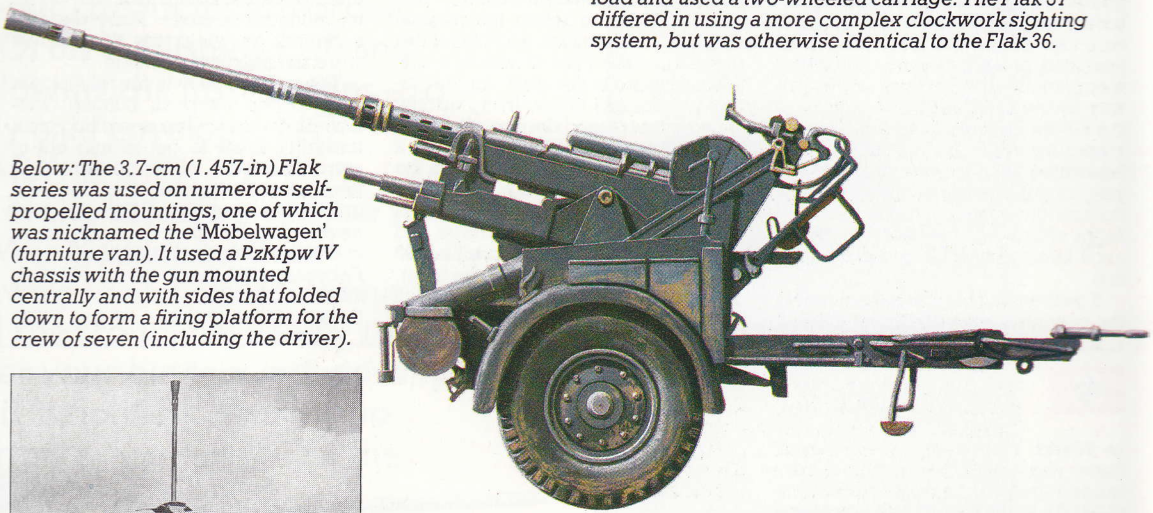
When the **3.7-cm Flak 18** entered service in 1935 it was regarded by the German army and Luftwaffe as a medium-calibre anti-aircraft weapon. It had been developed in Switzerland by Rheinmetall to avoid the stipulations of the 1919 Versailles Treaty, and for a time was known as the **ST 10** or **Solothurn S10-100**. When it was first introduced the Flak 18 suffered from many teething troubles which were eventually ironed out, but even in its final form was not regarded as much of a success. In the weapon's original form, the gun and carriage were moved on a heavy and complex twin-axled arrangement, but getting in and out of action with this carriage was slow. Moreover, carriage traverse was slow and the gun mechanism was so prone to stoppages that crews had to be highly trained to cope with them. For all these drawbacks the 3.7-cm (1.457-in) Flak 18 was never replaced in service. Some examples were exported to China before 1939.

Manufacture of the original Flak 18 ceased in 1936, and in the same year production began of a new gun with the same calibre. This appeared to be the same design as before, but there were many changes, not the least of which was a new type of ammunition with only one driving band in place of the original two. The carriage was much altered to allow towing on a single axle only. Overall the new gun, known as the **3.7-cm Flak 36**, retained the same performance as the earlier weapon but was much handier to use in action. There was one further variant, the **3.7-cm Flak 37**, but this differed only in the type of sight fitted: this was a complex predictor-type sight powered by clockwork.

The Flak 36 and 37 were produced in large numbers, and by August 1944 the Luftwaffe alone had 4,211 in service. The German navy used various forms of the basic gun on special naval mountings, and there was a version for use on submarines. There were also several self-propelled types, some hastily mounted on trucks and converted tank chassis, and some on half-tracks. In action the usual number of men to each gun was seven, one of them operating a portable rangefinder, but after 1944 this crew member was withdrawn. Ammunition was fed into the gun in linked six-round clips.

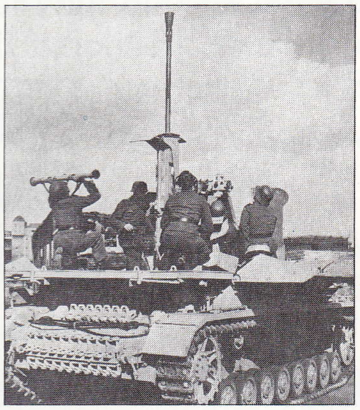
After about 1940 the Flak 18, 36 and 37 became the standard defence weapons against low-flying aircraft and were usually organized into nine- or 12-gun batteries. Many were statically emplaced on special flak towers that provided good all-round fire close to important target areas. Special flak trains that moved around the Reich to be in position wherever Allied air attacks were heaviest also carried numbers of Flak 36s or 37s. The type was also used in the field as an anti-tank weapon on occasion and one weapon developed for use on the Eastern Front was a muzzle-loaded stick bomb that was fired against tanks using a special blank cartridge.

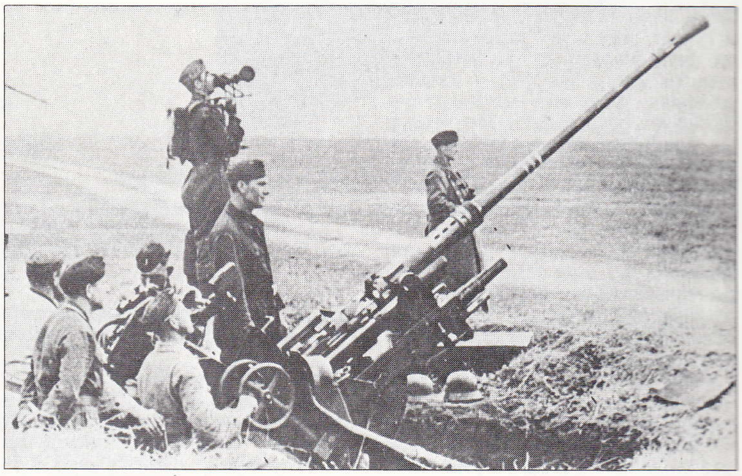
Production of the Flak 36 and 37 continued right up to the end of the war at three main centres (one in Czechoslovakia), but the Flak 36/37 was not an easy or cheap weapon to produce, a fact which led to the introduction of the Flak 43 guns.



On the move, the 3.7-cm (1.457-in) Flak 36 was a compact load and used a two-wheeled carriage. The Flak 37 differed in using a more complex clockwork sighting system, but was otherwise identical to the Flak 36.

Below: The 3.7-cm (1.457-in) Flak series was used on numerous self-propelled mountings, one of which was nicknamed the 'Möbelwagen' (furniture van). It used a PzKpfw IV chassis with the gun mounted centrally and with sides that folded down to form a firing platform for the crew of seven (including the driver).





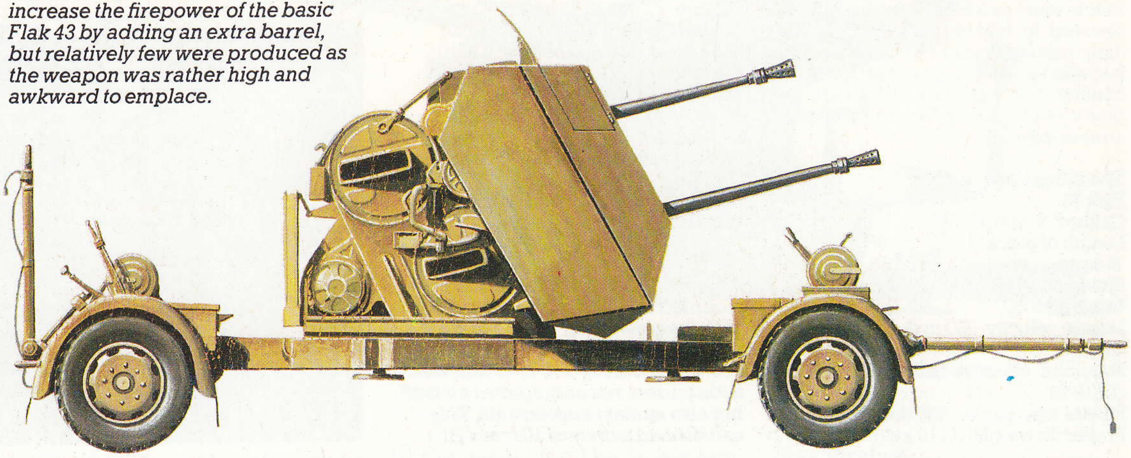
Right: A 3.7-cm (1.457-in) Flak 36 is in position as part of the Atlantic Wall coastal defences. This photograph was taken during 1940 or 1941, for the emplacement is still an earthwork (later it would be concrete) and the rangetaker is still included in the crew; later he would be removed to conserve manpower.

Specification

Flak 36 and Flak 37
Calibre: 37 mm (1.457 in)
Length of piece: 3.626 m (142.75 in)
Weight: in action 1550 kg (3,417 lb)
Elevation: –8° to +85°
Traverse: 360°
Muzzle velocity: 820 m (2,690 ft) per second
Maximum effective ceiling: 4800 m (15,748 ft)
Rate of fire: (cyclic) 160 rpm
Projectile weight: 0.64 kg (1.41 lb)

GERMANY

3.7-cm Flak 43 and Flakzwilling 43



The German 3.7-cm (1.457-in) Flakzwilling 43 was an attempt to increase the firepower of the basic Flak 43 by adding an extra barrel, but relatively few were produced as the weapon was rather high and awkward to emplace.

By 1942 the Allied air threat over all the various battlefields was reaching the point where there were never enough air defence weapons available. The 3.7-cm (1.457-in) guns were always in demand as they were the standard weapon against low-flying aircraft, and in 1942 Rheinmetall-Borsig was busy developing a gun to replace the existing costly and slow-to-make Flak 36/37 series. As ever, Rheinmetall-Borsig came up with a novelty, not in the gun or carriage design, but in the manner of manufacture: it decided to adopt methods already in use for small-arms production.

Rheinmetall-Borsig was in competition with Krupp for the new gun contract, and at one point the order was given to the Krupp gun, which used conventional production methods. But at the last moment the Krupp design developed weaknesses and Rheinmetall-Borsig got the award. This immediately resulted in the internal party and factional wrangling that often beset the German wartime industrial dream, so by the time Rheinmetall-Borsig was actually able to go ahead on a new production line well over a year had passed. Rheinmetall-Borsig was partially able to make up the leeway by the fact that its gun, known as the **3.7-cm Flak 43**, was produced with stampings, weldings and simply-fabricated components in the same way as sub-machine guns. The production time for a gun was cut by a factor of four, and the overall performance boosted by an increased rate of fire.

It was early 1944 before the first of the new guns was ready, and thereafter the type poured off the lines at Dürkopp. In service the Flak 43 proved very successful, but in the initial rush to get the new gun into production it had been decided to retain the original Flak 36/37 ammunition and barrel designs. Thus the Flak 43 was at a disadvantage from the start, for the increased speeds of low-flying aircraft and their increased degree of protection meant that a single strike from a Flak 43 did not always bring down the target aircraft. The only immediate answer to this was to multiply the number of barrels on a single carriage, and this led to the **3.7-cm Flakzwilling 43** with two barrels, one above the other, on a single mounting. This made a kill much more likely and the Flakzwilling became preferred over the single-barrel version. In the event both were produced until the end of the war, and there were even plans for a four-barrel mounting at one stage. There was also a project on which the two barrels were mounted side-by-side.

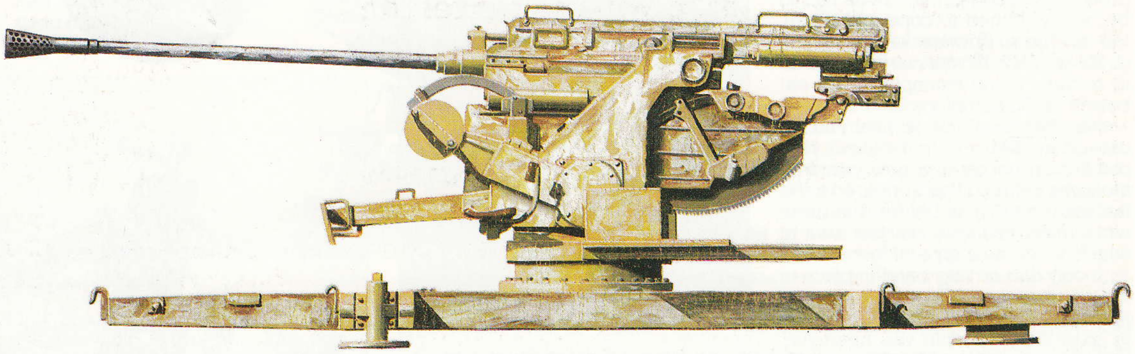
The single- and twin-barrel Flak 43s were potent weapons, but the twin-barrelled version was something of an unwieldy brute to get in and out of action because of its general top-heaviness. Fortunately for Allied air crews, the number of Flak 43s was never enough to meet demands, especially regarding the Flakzwilling 43. By February 1945 there were 1,032 Flak 43s of both types in service, but of these only 280 were of the twin-barrelled version. In action both types required six-man crews, and if a gun was to be maintained in action for any length of time more men were needed to supply ammunition to the gun.

Specification

Flak 43
Calibre: 37 mm (1.457 in)
Length of piece: 3.30 m (130 in)
Weight: in action 1392 kg (3,069 lb)
Elevation: −7.5° to +90°
Traverse: 360°
Muzzle velocity: 840 m (2,756 ft) per second
Maximum effective ceiling: 4800 m (15,748 ft)
Rate of fire: (cyclic) 250 rpm
Projectile weight: 0.64 kg (1.41 lb)

GERMANY

5-cm Flak 41



The 5-cm (1.97-in) Flak 41 was one of the least successful of all the German anti-aircraft guns, for it had excessive recoil and flash and the carriage traversed too slowly. Despite their shortcomings, 50 were used until the war ended.

In World War II air warfare terms there was an altitude band that extended from approximately 1500 m (4,921 ft) to 3000 m (9,843 ft) that existing anti-aircraft guns could cover only with difficulty. Aircraft flying in this band were really too high or too low for small- or larger-calibre weapons. What was obviously required was an interim-calibre weapon that could deal with this problem but, as artillery designers in both the Allied and German camps were to discover, it was not an easy problem to solve.

The German solution to the interim-altitude band situation was a gun known as the **5-cm Flak 41**, and the best that can be said of it was that it was not a success. It was first produced in 1936, and was yet another Rheinmetall-Borsig design that was preferred over a Krupp submission. Development of the prototype was carried out with no sense of urgency, for it was 1940 before the production contract was awarded and in the event only 60 guns were completed. The first of them entered service in 1941 and the type's shortcomings soon became apparent. The main problem was the ammunition: despite its 50-mm (1.97-in) calibre, this was rather underpowered and on firing produced a prodigious amount of muzzle blast and flash that distracted the aimer, even in broad daylight. The carriage proved rather bulky and awkward to handle in action, and despite the characteristics of the expected targets the traversing mechanism was also rather underpowered and too slow to track fast targets.

Two versions of the Flak 41 were produced: a mobile one using two axles to carry the gun and carriage, and a static version for emplacing close to areas of high importance such as the Ruhr dams. Despite their overall lack of success the guns were kept in service until the war ended, but by then only 24 were left. During the war years some development work was carried out using the Flak 41s, not so much to improve the guns themselves but to determine the exact nature of the weapon that was to replace them. In time this turned out to be a design known as the **Gerät 56** (Gerät was a cover name, meaning equipment) but it was not finalized before the war ended. One Flak 41 development was the formation of one battery operating under a single remote control.

In action the Flak 41 had a crew of seven men. Loading the ammunition was no easy task for it was fed into the gun in five-round clips that were somewhat difficult to handle. Though designed for use against aircraft targets, the Flak 41 was also provided with special armour-piercing projectiles for use against tanks, but this AP round appears to have been little used as the Flak 41 was one of the few German weapons that was not selected for mounting on a self-propelled carriage.

If the Germans were unsuccessful in their attempt to defend the interim-altitude band, it has to be stated that the Allies were no more successful. Typical of their efforts was the British twin 6-pdr, a 57-mm (2.244-in) weapon that never got past the trials stage because of its indifferent performance.

Specification

Flak 41
Calibre: 50 mm (1.97 in)
Length of piece: 4.686 m (184.5 in)
Weight: in action 3100 kg (6,834 lb)
Elevation: −10° to +90°
Traverse: 360°
Muzzle velocity: 840 m (2,756 ft) per second
Maximum effective ceiling: 3050 m (10,007 ft)
Rate of fire: (cyclic) 180 rpm
Projectile weight: 2.2 kg (4.85 lb)